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Casting Aluminum Cycle Parts

Congested Condition of Streets in Business Sections of Cities Has Opened New Fields for the Motorcycle—Make Many Parts of Aluminum to Secure Lightness

BY HERBERT R. SIMONDS

EXTENSIVE use of motorcycles has not been restricted by the rapid increase in the number of automobiles throughout the country, as might be supposed. On the contrary, the great congestion of business streets, due to the increased number of trucks and pleasure cars, has thrown a new demand on the manufacturers of motorcycles. The motorcycle equipped with a side car now is being used extensively for delivery purposes, since it may be driven in and out of traffic more speedily than a truck and also may be parked more quickly and easily. Manufacturers of motorcycles are experiencing a demand fully commensurate with that of manufacturers of motor trucks and automobiles.

The design and construction of motorcycles has been the subject of much study and development to meet the demand and to build a machine capable of standing up under the new service requirements. One of the principal changes that has taken place in the last few years has been the enclosing

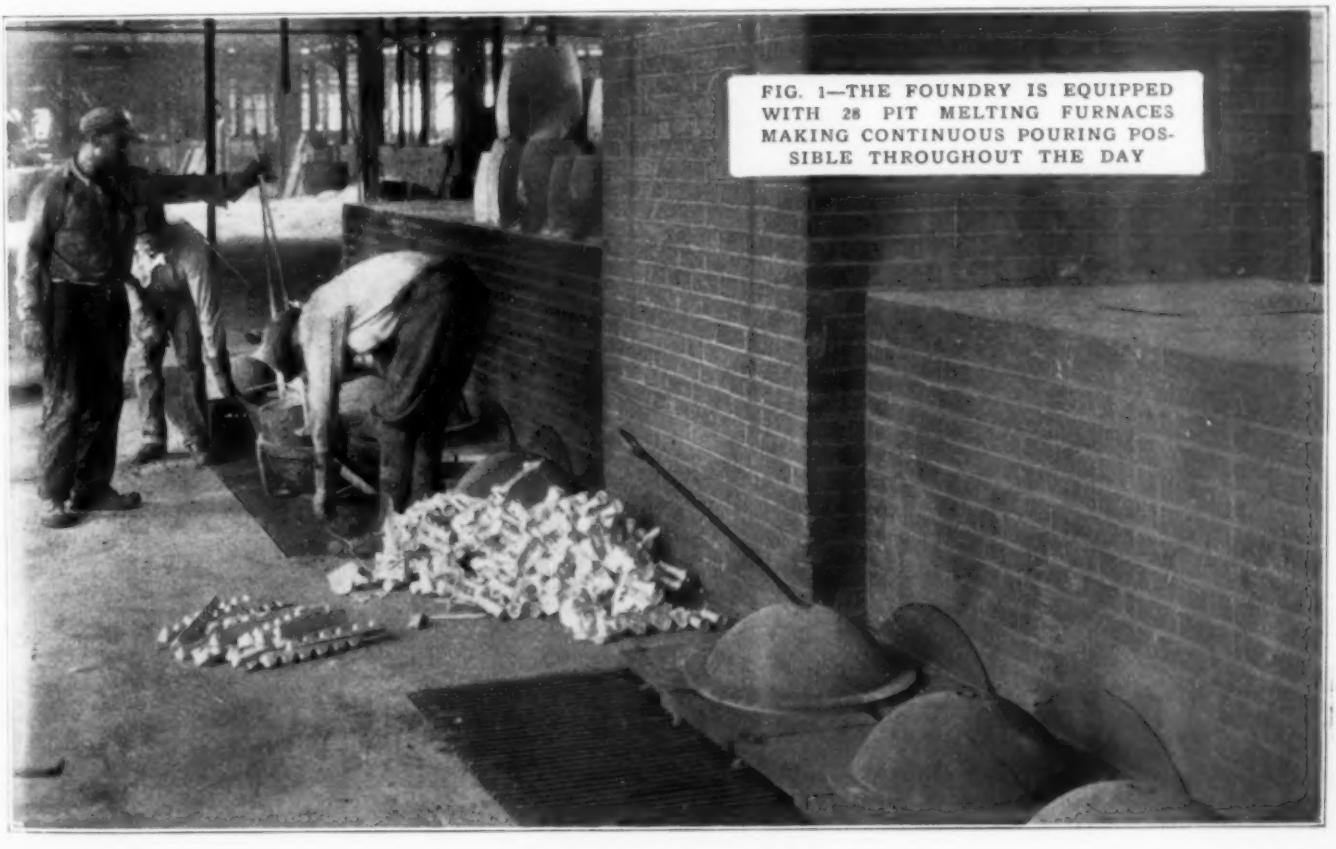


FIG. 1—THE FOUNDRY IS EQUIPPED WITH 28 PIT MELTING FURNACES MAKING CONTINUOUS POURING POSSIBLE THROUGHOUT THE DAY

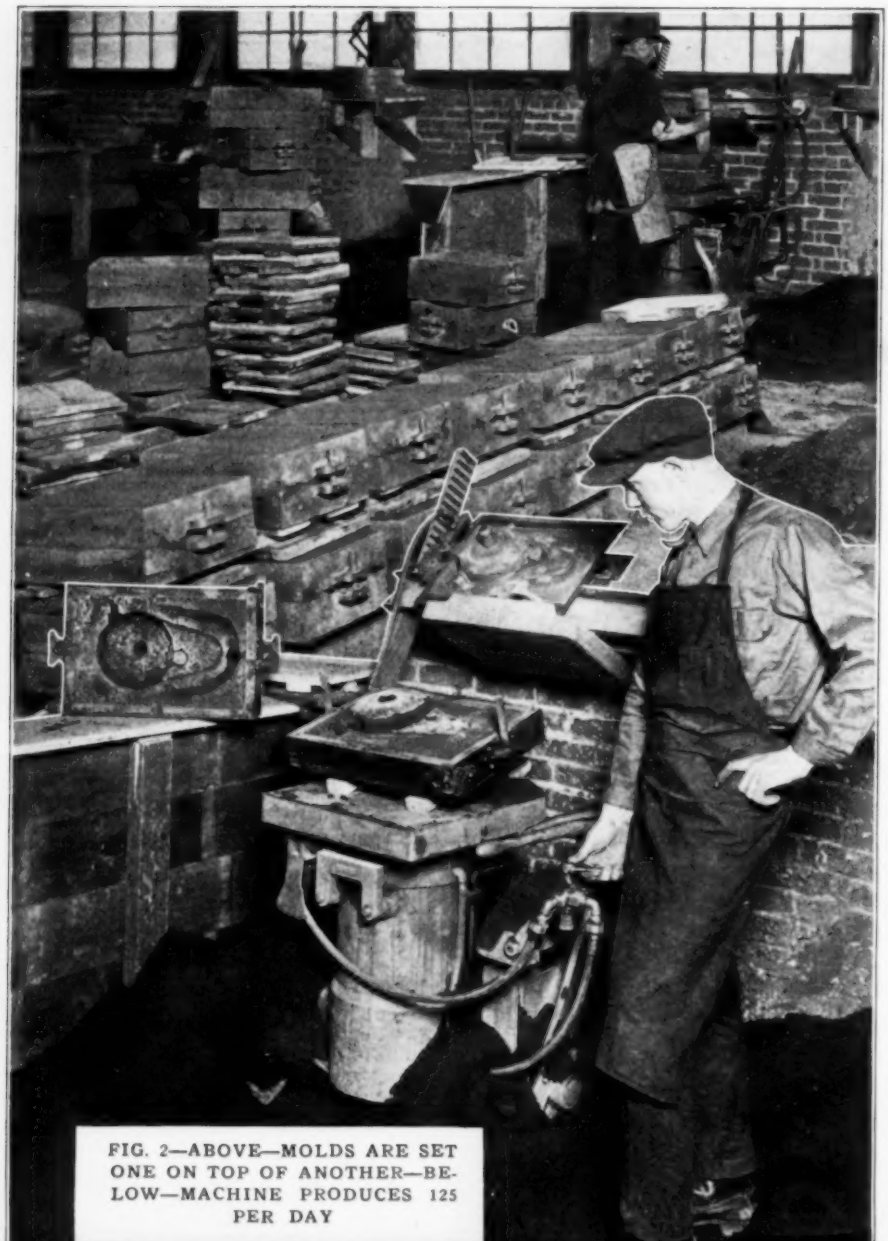


FIG. 2—ABOVE—MOLDS ARE SET ONE ON TOP OF ANOTHER—BELOW—MACHINE PRODUCES 125 PER DAY

of the power plant. Of course, this has necessitated the use of more metal and to keep the complete unit as light as possible, the use of aluminum castings has been increased. Crankcases, chain guards, and other parts now are cast successfully of an aluminum alloy.

To care for the increased demands for aluminum alloy castings and other nonferrous foundry business, the newly organized Springfield Malleable Iron Co., Springfield, Mass., has started a modern aluminum and brass foundry. The plant consists of large roomy, well-lighted buildings formerly used by the Harley company, and now in the process of rehabilitation. The nonferrous department practically is in full operation and the first malleable castings recently were poured. While still in the early stage, nevertheless, the operation of the foundry shows the results of an extensive study in laying out a foundry and in determining the proper sequence of operations.

The entire floor of the foundry is of concrete, which simplifies the transportation of materials from one department to another. New sand is brought in from the storage bins in a large three wheel tractor. This tractor, or one similar, is used in handling coal, coke, pig iron and castings throughout the entire plant.

In Fig. 3 are shown an assortment of motorcycle castings which now are being produced successfully in quantity at the Springfield plant. The molds for these castings are made with metal match plates on machines of the type shown in Fig. 2. In this illustration, the plate is shown resting on the cross bar of the machine and the cope and drag molds are shown complete and ready for assemblying.

A means of increasing production and economizing floor space is found

FIG. 3—ALUMINUM ALLOY MOTORCYCLE CASTINGS ARE MADE SUCCESSFULLY—FIG. 4—THREE MEN CONTINUOUSLY ARE ENGAGED IN POURING

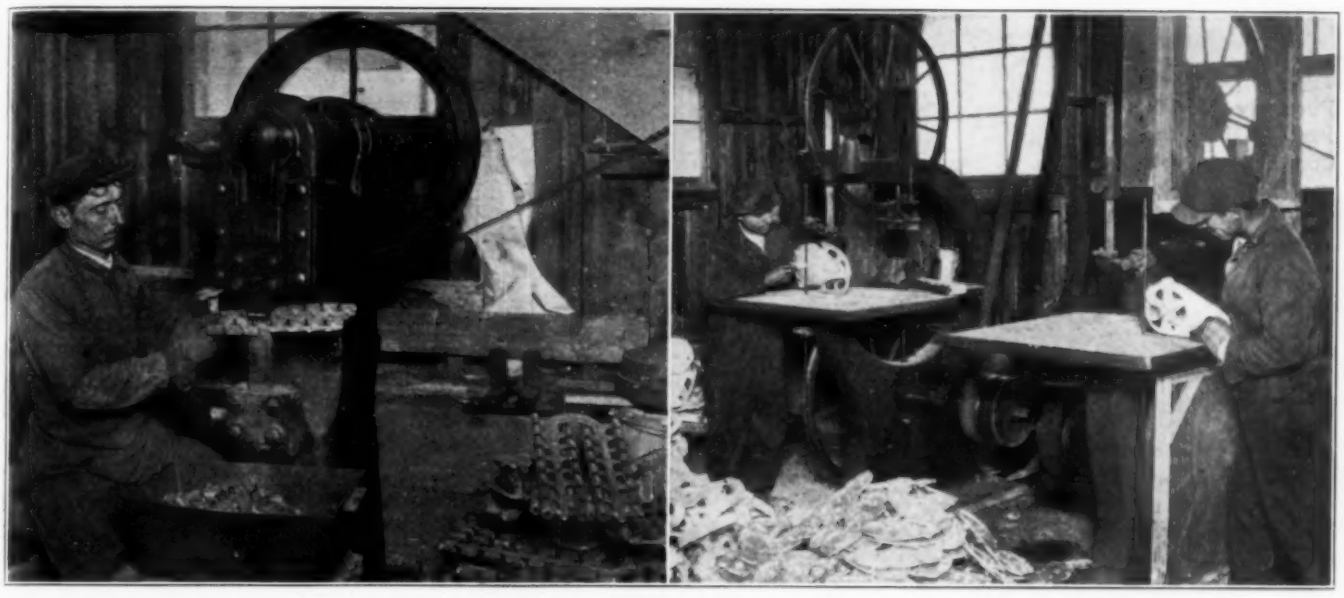


FIG. 5—A PROPERLY DESIGNED SPRUE CUTTER IS A PACEMAKER AS WELL—FIG. 6—BAND SAWS QUICKLY REMOVE FINS AND GATES FROM THE ALUMINUM CASTINGS

in the practice of placing molds one above the other in two rows for pouring. This method is illustrated in Fig. 2. By stacking the molds, time is saved in pouring, and less time and effort is required for the molders to carry the molds from the machine to the floor. The molder shown in Fig. 2. is at work on chain guards, such as that shown at the extreme right, Fig. 3.

Acts as a Header

The casting shown in the foreground of Fig. 6 is gated with a star gate at the center of a large circular opening. This form of gate gives a sufficiently wide distribution of metal to eliminate the necessity of a header with this type of casting. The gate is large in diameter, and therefore acts as a header.

A modern core room adjoins the molding floor. By close association and careful planning of the molding and core departments, it is possible to keep the core supply several hours ahead of the molders without resorting to storage. The cores are baked in a coal-fired oven of unusual design, which is shown in Fig. 7. The cores are baked on trays, each tray operating independently. The tray may be filled and revolved into the oven without the loss of heat or the disturbing of any of the cores. Each tray forms a quadrant of a circle with a door at each side, the tray being hinged at the corner so that the door on one side closes the oven when the tray is opened and the door on the other side closes the oven when the tray is closed. In Fig. 7 trays open and partly closed are shown.

When completed, the cores are carried to the molder's bench on small trays. A record of the number of cores delivered in each case is kept by the man in charge of the core room, and eventually the cost of operating the core room will be kept independently of the remainder of foundry work. Incidently, the importance of a good core room often is underestimated. Not only will accurate, correctly made cores increase the production of the molder, but often the design of the core may alter the method of molding and thus give a greater production.

One example of the influence of proper core design is shown in Fig. 8. Here an aluminum tread casting for an automobile is shown, which requires four threaded lugs embedded in proper places and held at right angles to the face of the work. At first, these lugs were placed in their position after the mold otherwise had been completed. The core prints were formed by the pattern and the small screws then were placed one at a time by hand in these core prints. As may be imagined, this was a slow and difficult job at best, but it was made all the harder in the case shown; since each screw was in the center of a raised hub, formed in the casting. In the mold the core prints came at the base of the holes which were too small to admit the fingers of the molder. Therefore, each screw had to be taken up with a pair of forceps, eased down into the core print, and then carefully adjusted for

FIG. 7—A SWINGING DOOR CORE OVEN WHICH MAKES POSSIBLE THE HANDLING OF EACH TRAY INDEPENDENTLY

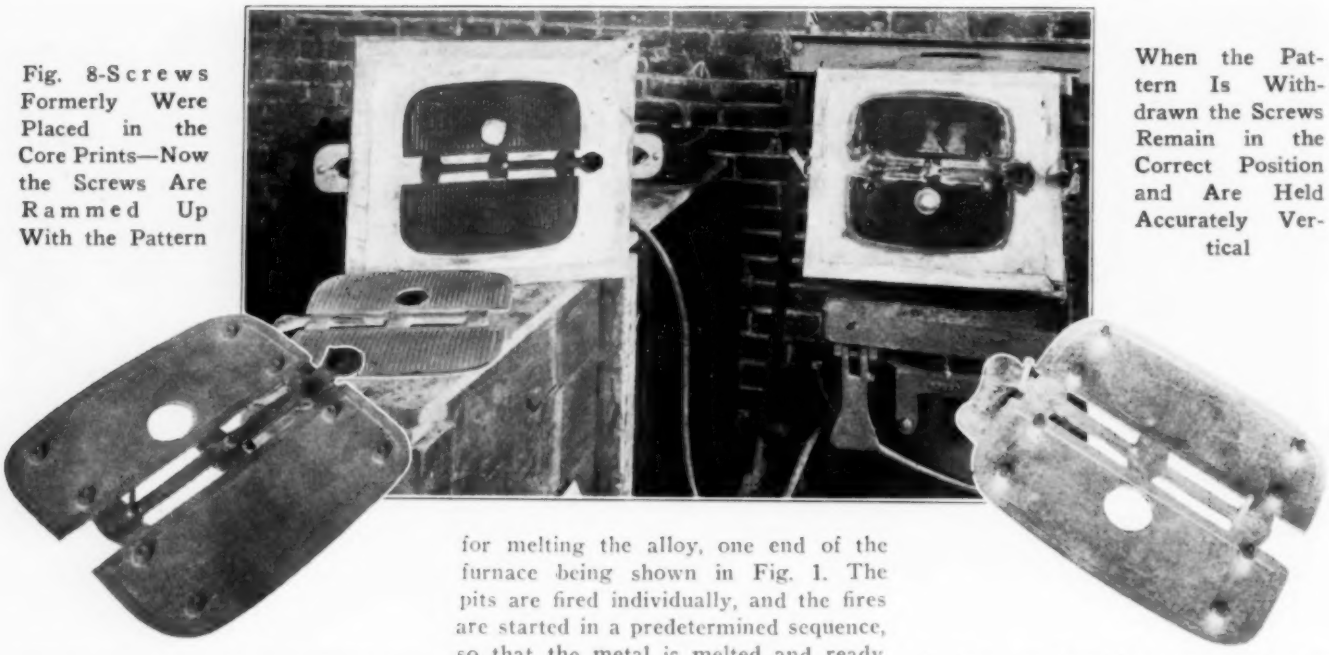


Fig. 8-Screws Formerly Were Placed in the Core Prints—Now the Screws Are Rammed Up With the Pattern

When the Pattern Is Withdrawn the Screws Remain in the Correct Position and Are Held Accurately Vertical

accurate alignment. After studying this process, the assistant superintendent devised the present method which eliminated much of the difficulty.

The pattern, which is shown at the left of Fig. 8, is drilled with holes just large enough to permit the small screws to be slipped in and held in position. The mold then is made up as follows: The core is rammed up on the rib side of the pattern. Then the flask is rolled over and the opposite side of the pattern, namely the side shown in Fig. 8, is dusted off and the screws set in the drilled holes. Sand is sifted over in the usual way, and the mold is rammed, care being taken to secure careful tamping around each screw. When the pattern is drawn the screws remain in the mold in exactly the same position as in the case when core prints are used, but they are held more accurately vertical and all the hand work of placing each screw is eliminated. By this simple means production was increased over 25 per cent.

Use Aluminum Alloy

From the pig metal to the complete alloy casting is a matter of but a few hours. Cold pigs, which are thrown into the crucibles at 9 o'clock are poured at 10:15 loaded and carried to the cleaning room at 10:30 and are loaded in trucks ready for the customer by noon. The pigs, or hardners as they are called, are made up in the plant by melting down 50 per cent virgin aluminum with 50 per cent of electrolytic copper. These pigs then are melted with the correct proportion of virgin aluminum to produce an alloy containing approximately 92 per cent aluminum and 8 per cent copper. Twenty-eight pit furnaces are made use of for melting the alloy, one end of the furnace being shown in Fig. 1. The pits are fired individually, and the fires are started in a predetermined sequence, so that the metal is melted and ready to pour at regular intervals, and pouring is continuous throughout the day. The pit furnace is suited admirably to this sort of work. Fifty and 100-pound crucibles are used, and each pit turns out five heats a day, so that using 100-pound crucibles, each pit has a capacity of 500 pounds a day. After the first heat, the time required for additional heats is about 1 1/4 hours. Crucibles are made of graphite, and buckwheat charcoal is used as a flux.

The pouring gang is on the job all of the time, not more than 25 molds being allowed to accumulate at one time before pouring. The present method of pouring, as shown in Fig. 4, is to be supplanted by an overhead trolley system extending the length of the molding floor. The particular casting which is shown being poured in Fig. 4, is of such a nature that no weights are required on the molds. In some cases, a steel retaining band is used around the joint between the cope and the drag.

The metal hardens quickly and this makes it possible for the clean up gang to follow on the heels of the pouring gang. The castings are raked out of the sand and dumped into wheelbarrows for transportation to the cleaning room. The barrows, one of which is shown in Fig. 4, are placed conveniently about the molding floor and when full are wheeled into the cleaning room, which adjoins the molding room.

A view of a corner of the cleaning room showing two band saws in use in removing headers, gates and other excess metal, is given in Fig. 6. The trimmer is shown cutting off the complete gating from the casting in one operation. From three to four of these casting thus are trimmed in a minute, all time for handling and sorting of material being included. Another efficient tool for use in trimming nonferrous castings is shown in Fig. 5, this machine being a sprue cutter. The operator is shown cutting small bronze sleeves from a double gate. The cutter works continuously at about 75 strokes per minute, unless stopped by the operator. After a little experience, the operator is able to make each stroke result in a clean cut at each sleeve. The timing of the stroke acts as a pacemaker for the operator and in this way helps to speed production.

Companies Consolidate

The Detroit Machine Tool Co., Detroit, has been consolidated with the Norton Co., Worcester, Mass., manufacturer of grinding wheels and grinding machines. No change in the business policy of the Detroit company is to be made. Harold W. Holmes will continue as president and general manager and the centerless grinders will continue to be manufactured at the Detroit plant. The following officers and directors of the Norton Co. have been added to the Detroit Machine Tool Co.: Clifford S. Anderson, vice president, Henry Duckworth, treasurer, William LaCoste Nelson and Aldus C. Higgins.

A Correction

Through error, two names given in the list of officers of the Detroit Foundrymen's association, on page 576, of the July 15 issue were wrong. J. J Boland, Griffin Wheel Co., Detroit, is vice president of the association while James L. Mahon, American Car & Foundry Co. is a member of the executive committee.

Find Actual Cost of Castings

Discuss Equitable Methods Whereby Foundrymen May Consider a Price for His Work on a Basis That Would Be Fair To His Customer as Well as To Himself

BY GEORGE B. COCKER

WE HAVE received from time to time much information of various methods by which the actual cost of castings may be determined, providing the methods or rules laid down are strictly carried out. It would seem that sufficient information has been volunteered to enable a foundry, regardless of its size or type of equipment, to figure out a fool proof method whereby castings may be sold without unreasonable profit or loss to the foundry.

All foundrymen have a general idea of approximately what it costs to produce castings, and assuming that this is correct, what excuse or explanation can be offered for the wide variaton in the prices for which the same identical castings are offered to a customer by a number of competitive foundries. Take for example a type of casting offered a customer for 9 cents per pound by one foundry, and which can be purchased by another foundry for 5 cents per pound. One must realize that the particular foundry quoting 9 cents per pound on the casting is trying to take advantage of a customer's ignorance in the matter of what castings cost, or else the foundryman offering the same casting for 5 cents per pound has become tired of the foundry business, and decided to get out of it by the long, drawn out route of selling under actual cost of production, which eventually will wind up in a sheriff's sale.

Assuming that both foundries referred to are managed by competent men, no single item or number of items entering into the cost of the casting could create such a wide difference in the prices, regardless of how the two concerns would compare as to volume of business being done, or the type of equipment which was used.

Items Affecting Selling Price

The main items entering into the selling price of the casting are labor, raw materials, supplies, overhead and profit, which would be practically the same with both foundries, excepting in a case where the casting could be produced by molding machines. In the latter instance, a foundryman having these machines could underbid one operating a shop not so equipped.

We will not deal with conditions so widely dissimilar, but with jobbing foundries handling a character of work which does not permit molding machines to be used to advantage. The majority of foundrymen have a general idea as to what it costs them to produce their castings, or at least sufficient information to enable them to compute a selling price whereby a customer is not overcharged or where prohibition is not placed on a legitimate profit such as other enterprises demand, expect and receive.

In the busiest times this country has ever known, during and subsequent to the war, the average jobbing foundry of the South received less compensation in return for money, energy and brains employed than any other legitimate enterprise, whether it was merchandising or manufacturing. It would seem then, under the circumstances, that something is radically wrong, either with the methods of keeping costs, the knowledge of what should be a legitimate profit on known costs, and investment, or else the foundryman is deliberately blinding himself in ignoring such things in an effort to take the business away from a competitor regardless of the consequences. It is hard to believe that foundrymen will persist in knowingly overcharging a customer, or on the other hand, in selling his product at figures that eventually will ruin him or at least prevent him from receiving the same compensation that all legitimate enterprise and investment should receive.

The author's company, the Cocker Machine and Foundry Co., Gastonia, N. C., is engaged in the manufacture of textile machinery, and also does general jobbing work which brings it into competition principally with the jobbing foundries of North and South Carolina. We are in a position to know in a general way the prices secured on various classes of foundry work, and especially textile machinery castings.

We found that we could sell a number of types of textile machinery castings considerably lower than our competitors, also that in a great many other types of castings they were just as much below our price. This condition clearly indicated that as a whole the methods of arriving at *their* selling price of castings were wrong, or else the method by which we arrived at *our* selling price was wrong. We endeavored to figure out a basis whereby we could determine the same percentage of profit or loss on every casting coming through our foundry, regardless of the character or weight of that casting.

Little Attention Given Costs

For example, if our method produce a net profit or loss of ¼ cent per pound on a casting weighing ½ pound, we would show that same net profit or loss on a casting weighing 500 pounds. We felt sure that the wide difference in the prices quoted on similar types of castings by competitive foundries was due to the little attention given to the wide difference in the cost of producing different types of castings in the average jobbing foundries of these sections.

It readily may be understood that if the foundryman had availed himself of the information given him to compute his costs, and he had figured his costs to be 4 cents per pound based on the general average output of his foundry for a given period, if he continued figuring on this basis regardless of the changes which are occurring daily in the types of castings produced, caused by fluctuations in the prices of raw materials, supplies and labor, he must under some of these varying conditions, at times be overcharging his customers, or again selling them castings at a loss to himself.

In our effort to avoid either overcharging a customer, or selling him castings at a loss to ourselves, we based our selling price of castings on two factors, first, the actual time it took the molder to produce a casting, and second, the amount of metal it took to pour it. Each of these two factors bore its proportionate amount of all cost items entering into the production of a certain casting, with a certain percentage of profit, added to each factor, which gave us our selling price to a customer. In other words, the two factors were classed as *labor* and *material* used. The *material* factor covered costs for all items of expense, labor, supplies and raw materials used, and a proportionate amount of overhead charges, with a certain percentage of profit on iron at the spout, and reduced to a fixed cost per

From a paper presented at the Asheville, N. C. meeting of the Carolina members of the Southern Metal Trades association, July 9, 1924. The author, George B. Cocker, is state vice president of the association.

pound for the melted iron, which easily could be changed from time to time to suit any changes which might occur in any of these items. The *labor* factor covered costs of all items of expense of labor, supplies, cleaning, shipping, and a proportionate amount of overhead charges, together with a certain percentage of profit from the time the iron left the spout until shipped or delivered to the customer.

The *labor* factor in our selling basis was reduced to figuring the number of minutes actual molding time taken to produce the casting and could be changed quickly to suit any variation which might occur in any of the items which were included and used in the establishing of the labor factor.

The item of percentage of profit in both factors, always remains the same, and whether it is or is not a profit must depend on whether the foundryman has or has not figured in all of his cost items.

Every casting coming out of our foundry and delivered to our own machine shop or our jobbing casting customers, is sold on this basis, and as our machine shop is our largest individual customer, we cannot afford to make any mistakes or blind ourselves to our foundry costs in selling our castings. Furthermore, we must make a profit in our foundry as well as our machine shop, or it would pay us better to shut down our foundry, and buy our castings from a jobbing foundry who can make them cheaper.

Devises List and Discount System

To take care of the fluctuating items in the two factors which we use in figuring our selling price of castings, we use a list and discount system the same as is commonly used in handling staple articles such as shafting, belting, screws, bolts, etc. The list prices on our various types of standard and special castings are always the same, but the discount is continually changing as is required to meet any changes that may occur in the cost of any of the items which go into determining either of the two selling factors. This method is also carried out with our customers in the invoicing our castings. We sell so many pounds of blanks or castings of a certain type at a list price of so much per pound, with a certain discount to apply. Each different type of casting carries its own particular list price, as discount could not be applied properly otherwise so as to work the same on all types produced.

The basis on which to determine the selling price of castings under the two factors may be explained simply as follows:

Under materials factor, the fluctuations will be governed by cost of raw materials, labor, loss in melting, gates returned, lost or bad castings, and the number of pounds of castings a molder could produce of a certain type in the molding time of 7½ hours per day or in 450 minutes.

Divide the *material* factor into divisions, from 50 pounds up to 950 pounds each division advancing 50 pounds to the next division.

As an illustration, figuring that a molder has a pattern that permits him to make 10 castings in 450 minutes, and these 10 castings weigh 5 pounds each, we have 50 pounds for his floor for that day's work. Our basis under such conditions requires us to charge at a rate of $7.60 per hundred pounds for cost and profit on the materials going into that type of casting.

Under our *labor* factor which remains more stationary than the *material* factor, we make a charge of 4.90 cents per minute for the molding time on producing any type of casting, so that in this particular case, if it takes the molder 450 minutes to produce 10 castings, the labor will be charged at $22.05.

The materials factor to be charged which figures 50 pounds of castings at $7.60 per hundred pound equals $3.80 and the labor factor of $22.05 makes the selling price for these 10 castings $25.85, or a per pound net selling price of 51.7 cents. Each division in the materials factor advances by 50 pounds into other divisions up to 950 pounds.

As the divisions advance in number of pounds, the price figures on these divisions decline, such for instance, 50 pounds division, $7.60 per hundred; 100 pound division, $7.40 per hundred; 200 pound division, $7.00 per hundred; 250 pound division, $6.80 per hundred and so on up to 950 pounds or the nineteenth division, where the materials factor has reached $4.00 per hundred. Under this basis of figuring our selling price, if the 10 castings had weighed 950 pounds, and the same amount of labor 450 minutes, the labor factor would still figure $22.05, and the materials figure would change to $38.00, making a total net selling cost of these 10 castings of $60.05, or at a rate of $6.32 per hundred pounds. If these same 10 castings had weighed 400 pounds, which placed them in the eighth division, with these same 450 minutes labor factor, the labor factor would still figure $22.05 and the material factor would have figured 400 at $6.20 per hundred, or a net selling cost of $22.05 for labor and $24.80 for materials, making a total of $46.85, or at a rate of 11 7/10 cents per pound. The amount of molding labor required to produce a certain type of casting determines the division in which that casting belongs to make a proper figure for the materials factor which enters into the determining of a proper selling price to show a profit.

Working under such a method, we must either show a profit or a loss on every pound of casting coming out of our foundry, and if we are showing a loss, it is because we have left out some items of expense in figuring the two selling factors. This, if discovered, could be remedied easily by adding the amount of the missing items, and assigning them to one of the two factors with which it properly belonged.

Announce Round Table on Electric Iron

A round table meeting has been arranged by the American Electrochemical society through its electrothermic division to discuss electric furnace cast iron. The meeting is called for Thursday noon, Oct. 2, 1924, at the Hotel Tuller, Detroit. This meeting will be held on the first day of the society's fall meeting, Oct. 2 to 4.

All persons interested in the electric furnace, in cast iron or the melting and treatment of cast iron in the electric furnace are invited to attend the round table meeting which will be preceded by an informal luncheon.

George K. Elliott, Lunkenheimer Co., Cincinnati, who is a pioneer in the field of cast iron electric furnace metallurgy, is chairman of the society's electrothermic division and will act as chairman of the round table discussion. Dr. Richard Moldenke will open the discussion. A number of well known men in the fields of cast iron and electric furnaces have stated their intention of being present at the meeting.

The intention is to bring together in an informal way electric furnace builders, electric furnace users and prospective users, metallurgists, foundrymen and representatives of central power stations to enable the meeting to be broad in scope, and have as far reaching an effect as possible.

Transfer Representatives

Ross Watson, formerly district manager of the Cleveland office of the Chicago Pneumatic Tool Co., New York, has been made district manager at Minneapolis to succeed D. M. Wesbrook, now general manager of the Canadian Pneumatic Tool Co., Ltd., Montreal, Que. Other recent changes include the transfer of L. J. Westenhaven from the Pittsburgh office to Cleveland as district manager and the removal of E. C. Stroup, compressor engineer in the Boston territory to the Pittsburgh district.

Adopt Powdered Coal System

Advantages Claimed as a Result of Burning Fuel in Radiator Shop Include Neatness and Economy and a Considerable Reduction in the Cost of Melting and Annealing

THEORETICALLY it is apparent that coal may be burned more economically and efficiently in the powdered than in any other form and only the initial cost of the equipment and the mechanical difficulties, which to some extent hindered the smooth operation of the early installations up to the present, have prevented its universal adoption. Where coal is burned on a grate in the usual manner a considerable proportion of the fine fuel sifts through the grates unburned. Further, unconsumed carbon floats up the stack and is dissipated in the form of smoke and after the fire has served its purpose either in melting or annealing iron, the remaining quantity on the grates or in the firebox is wasted. Average results of experiments to determine the thermal efficiency of a coal fuel bed indicate that it is necessary to supply at least 50 per cent more air than actually is consumed to secure perfect combustion and eliminate the objectionable smoke. A cubic inch of coal exposes 6 square inches of surface for the absorption and liberation of heat, but when coal is pulverized to a fineness of 80 or 90 per cent and passed through a 200-mesh sieve, the cubic inch is divided into about 25,000,000 minute particles thus exposing many square feet of surface when suspended in the air. Combustion is obtained by the combination of the carbon and hydrogen in the coal with the oxygen in the air. Approximately 150 cubic feet of air are required to burn a pound of powdered coal and where the combination is arranged properly for the work in hand every minute particle of coal is surrounded by just the correct amount of air for its complete combustion. This arrangement eliminates waste of carbon in the smoke or ash. When the heat no longer is required the flame may be extinguished instantly and no further fuel is wasted.

Among the larger foundries which have installed powdered coal equipment for melting and annealing castings the malleable iron foundry of the American Radiator Co. Buffalo, offers an interesting example. The system has been in use for over a year and naturally long since has passed the experimental stage. The furnaces and ovens formerly were fired in the usual manner over a period of many years by shoveling coal into a fire box at one end. The employes had become accustomed to the method and had attained a sufficient degree of skill in the manipulation of the flame to insure a high degree of quality in the ensuing castings. They easily and readily adjusted themselves to the routine of the new practice and eventually became enthusiastic supporters of a process that reduced labor and increased production.

Plant Has Large Capacity

The foundry as may be noted from the illustration Fig. 4 is well lighted from the roof and side walls. Molding, which embraces castings from the smallest up to those 100 pounds in weight, is carried on in the side bays. Six 30-ton furnaces occupy the greater part of the space in the center bay. They are provided with tapping spouts on both sides and furnish metal to the molding floors on both sides simultaneously. The furnaces are arranged in pairs or units of two and operated in such a manner that one of each pair is actively in service while the other

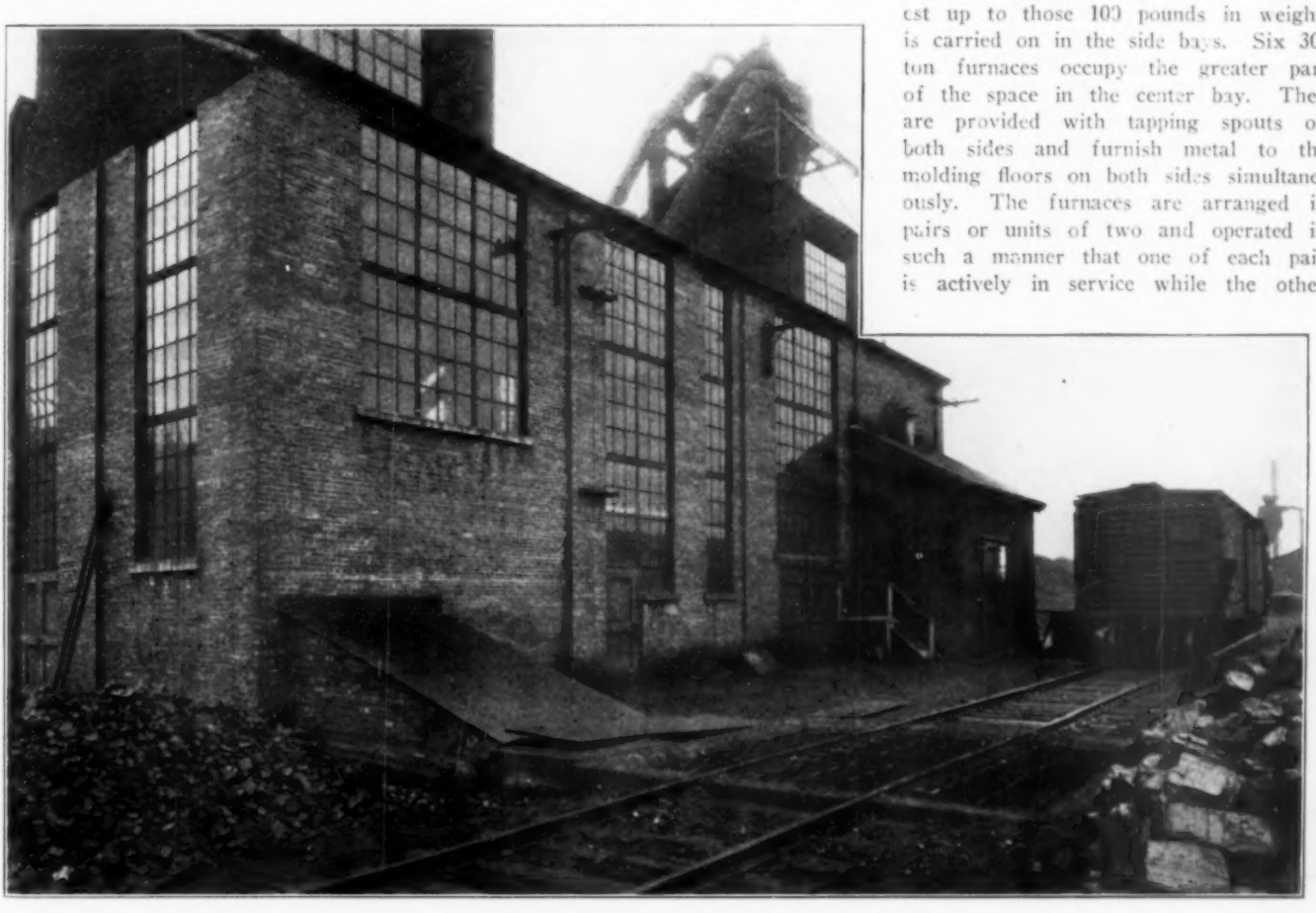


FIG. 1—COAL IS DUMPED THROUGH A GRATING IN THE TRACK, EITHER DIRECTLY FROM THE BOTTOM OF THE CAR OR FROM A STORAGE PILE IN THE IMMEDIATE VICINITY

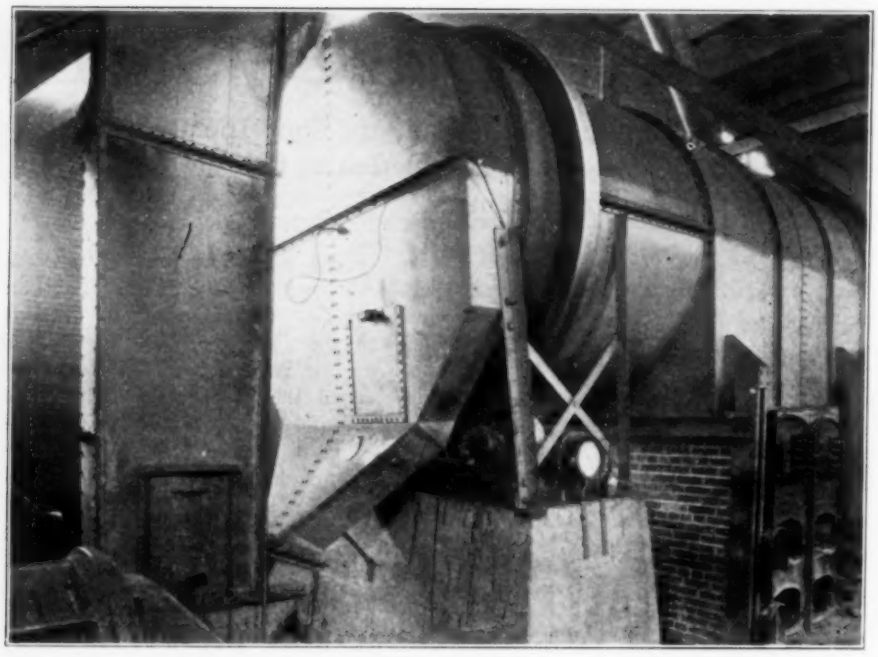


FIG. 2—A PYROMETER CONNECTED IN A SUITABLE MANNER AT THE DISCHARGE END OF THE DRYER INDICATES THE TEMPERATURE OF THE CRUSHED AND DRIED COAL

is undergoing repairs. Under this arrangement metal always is available near the center and at both ends of the shop and the distance to which it must be carried is reduced to a minimum.

The furnaces are served by three 5-ton cranes made by the Whiting Corp., Harvey, Ill. A runway supported on steel columns extends from one end of the building to the other end and on this runway the cranes are free to move while handling the charging pans, bungs, metal, slag and other materials incident to the operation of the furnaces. A similar 5-ton bridge crane made by the same interest is mounted in one of the adjoining bays and serves the annealing ovens 12 in number which in passing it may be of interest to note are considerably wider than the average oven used for the purpose. The foundry building 300 x 500 feet is a good example of modern construction and design and has been planned for future extension either to one side or to one end. Before proceeding with a description of the powdered coal installation, a description with which this article primarily is concerned, it may not be out of place to refer briefly to a few outstanding features in connection with this plant.

Diversity of Product

About 25 per cent of capacity is devoted to the production of castings for the company's own requirements. The remaining 75 per cent is made up of miscellaneous castings for railroad, agricultural and automobile trade. Practically all the patterns are mounted on matchplates for use on the bench or on machines and operators are recruited from common labor developed under the care of an instructor. Marked lack of skill after the preliminary training period does not necessarily earn dismissal for the embryo molder. He is shifted in turn from one job to another and usually he fits into some niche satisfactorily before proceeding far. In fact, instances are not uncommon of a man failing dismally to make the grade on several jobs in succession and then become a brilliant performer on some particular job afterward. In the event that he fails to make good after a fair and extended course of instruction, he either is relegated to the ranks of unskilled labor in the stockyard, the cleaning room, or on the furnaces or ovens, or he is dropped from the payroll definitely. However, with the numerous classifications under which the work is handled the management rarely finds itself under the necessity of adopting the latter alternative.

Use Automotive Trucks

Sand, cores, flasks, scrap, refuse, castings and a considerable part of the furnace supplies are conveyed from place to place on a battery of five automotive trucks made by the Clark Tructractor Co., Buchanan, Mich. The cement floor and wide gangways are particularly well adapted to this method of transportation. Scrap castings and other materials for the furnace charge are loaded in steel boxes and are equipped to be handled and dumped by the crane.. Other features of the foundry include an extensive cleaning room equipped with all the necessary devices for handling the castings both in the hard state and after they have been annealed. Many customers supply their own patterns, but the plant is provided with a pattern shop capable of taking care of all the new patterns ordered, also the repair of those in use. Cores are made at both ends of one of the side bays. The larger cores are made and baked on the floor level at one end and the smaller on the second story at the opposite end of the same bay.

The entire plant for burning powdered fuel at the plant of the American Radiator Co. was designed, supplied and erected by the Grindle Fuel Equipment

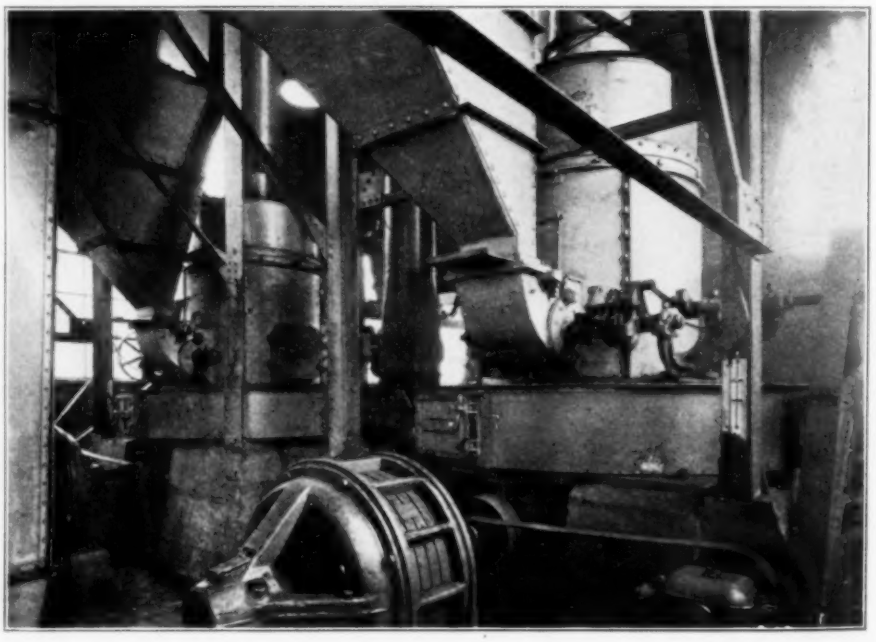


FIG. 3—THE COAL IS PULVERIZED IN TWO MILLS WITH A CAPACITY OF 5 TONS EACH—THE MILLS ARE DRIVEN INDEPENDENTLY OF EACH OTHER

Co., Chicago, now affiliated with the Whiting Corp., Harvey, Ill. It is claimed this installation presents the latest development in the reception and preparation of the coal also an improved method of controlling the coal and air in the conveying and firing system. Several details in connection with the equipment and method of operation are shown in the accompanying illustrations.

Coal is dumped direct from the bottom of the car or from a storage pile through the grating in the track shown near the center in Fig. 1. From the hopper under the grating the coal is conveyed by an apron conveyor into the building shown to the left in the same illustration. This building contains all the necessary equipment for preparing the coal and for sending it on its way to the various points in the foundry building located at a considerable distance where later it is utilized. The coal enters the preparation building at the floor level at the left end of the building and finally is discharged through the series of pipes and hoppers above the roof at the right.

Coal is passed through several pieces of crushing, grinding and conveying equipment before it emerges in the prepared form in which it is fed to the burners in the furnaces where the iron is melted and also in the ovens where later the castings are annealed. In the first crusher it is reduced to a mass in which no lump is over 1¼ inches. From this crusher it is carried to a considerable height on a bucket conveyor and discharged upon a broad belt passing over a magnetic pulley which removes any stray pieces of iron or steel.

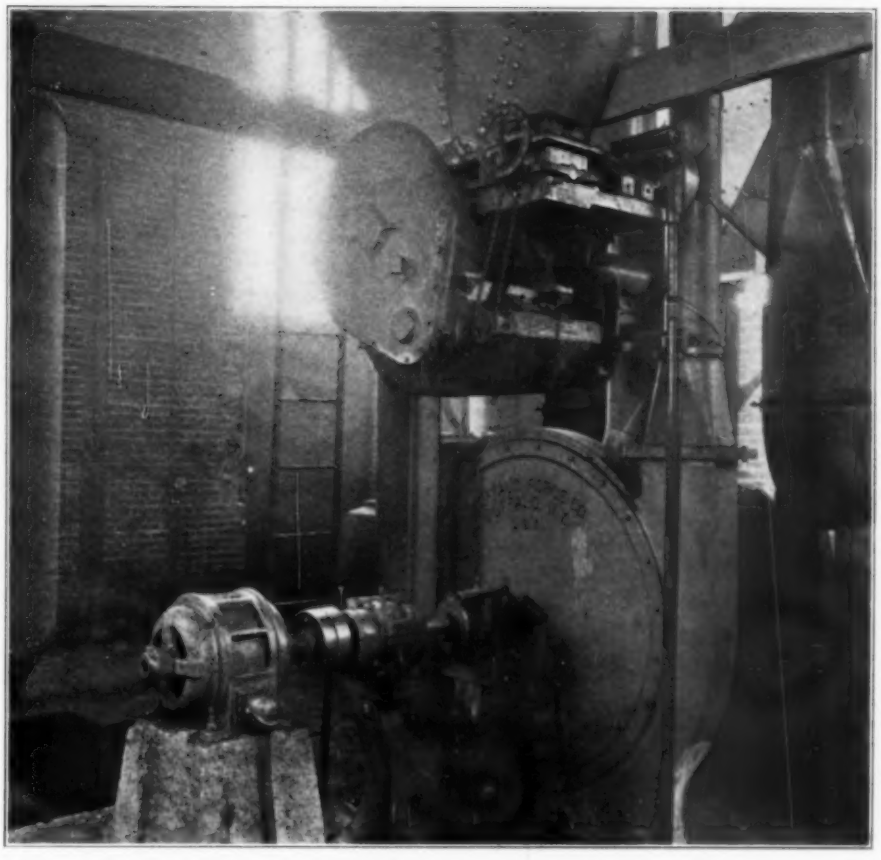


FIG. 5—A VARIABLE SPEED SCREW FEEDS THE COAL IN ANY DESIRED VOLUME INTO A FAN WHICH DISCHARGES IT THROUGH THE MAIN SUPPLY PIPES IN THE FOUNDRY

The coal falls into a scale which automatically weighs and dumps it into a hopper with a holding capacity of 40 tons located directly above one end of the coal dryer shown in Fig. 2.

Up to this point no attention is paid to the condition of the coal, whether it is damp or dry. All coal is permeated with moisture to a greater or less extent, depending somewhat on the condition of the coal seam and also on the time the coal has been exposed to the atmosphere without benefit of cover. The moisture must be expelled before the coal is pulverized and forwarded to the burners in that condition. In the

FIG. 4—AUXILIARY AIR TO PROMOTE COMBUSTION IS DRAWN THROUGH A 4-DISK GAGE WHICH MAY BE OPENED OR CLOSED TO REGULATE THE AMOUNT IN ACCORDANCE WITH CONDITIONS IN THE FURNACE

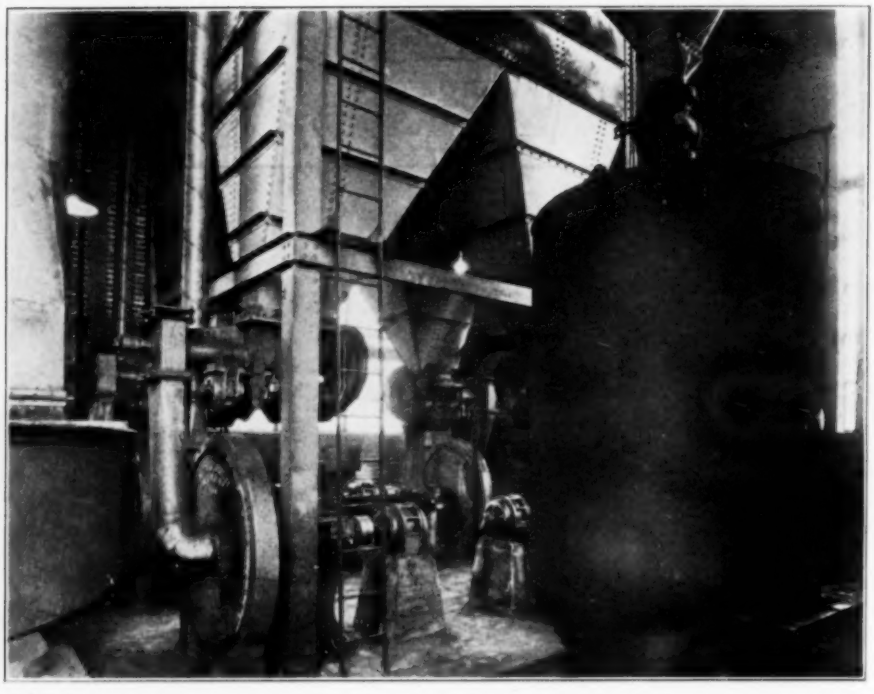


FIG. 6—PULVERIZED COAL FOR THE ANNEALING OVENS FIRST IS COLLECTED IN A 5-TON CAPACITY TANK MOUNTED ON A SCALE AND THEN CONVEYED THROUGH A 4-INCH PIPE TO THE TWO HOPPERS ABOVE THE OVENS

dryer the moisture is reduced to a content of less than 1 per cent and as a result practically no friction develops in the pipes through which it is conveyed.

From the 40-ton hopper the crushed coal is fed to the dryer by a motor driven screw feeder equipped with a mechanical speed control which regulates the quantity of material entering the dryer at all times. The coal passes through the revolving dryer and automatically is discharged through a chute at one end into the boot of an elevator as shown in Fig. 2. This illustration also shows the firing doors under the dryer, also the pyrometer which indicates the temperature of the coal as it passes from the dryer to the discharge chute. The fireman watches the pyrometer closely and regulates his fire to maintain an even temperature in the dried coal. In this particular instance the furnace is fired by hand and differs in that respect from the majority of the installations made by the Grindle Fuel Equipment Co., where powdered coal is burned in the fire chamber.

A bucket elevator receives the coal from the dryer and discharges it into two 3-ton steel bins which in turn feed it into two 5-ton mills shown in Fig. 3 where it is pulverized to the desired degree of fineness. Exhaust fans are employed to raise the pulverized coal from the mills to the collectors where the air and coal are separated by gravity. The coal settles down into a 30-ton hopper which supplies the feeders that force the coal into the pipe lines leading to the furnaces and ovens.

The coal preparation plant is located outside the foundry building and at a point approximately opposite the center of the battery of six melting furnaces in the foundry. With this arrangement it is apparent that the lines leading to the end furnaces are longer than those which feed the coal to the furnaces in the center of the battery. The actual distance in the first instance is 600 feet and in the second it is 400 feet. The feed screw mechanism for one unit is shown in Fig. 5. The screw is of special design and delivers coal in uniform volume, but since the screw may be operated at a variable speed the total volume of coal passing through the pipe may be closely regulated at all times. The speed is controlled electrically from a panel erected a short distance outside the firing end of each furnace, and in that manner may be watched closely by the furnace tender.

A dial on the panel indicates the amount of coal passing into the furnace and through the push button control may be varied at the will of the furnaceman from 15 to 40 pounds per minute. One of the furnaces with complete firing unit is shown in Fig. 4. The simplicity, cleanliness and convenience of the equipment are quite apparent. With this style of equipment no bin is required in the vicinity of the furnace, thus eliminating a factor that might interfere with the safety and speed of the cranes serving the furnaces. The firing equipment is shown to the left in Fig. 4 and comprises an exhauster which receives the coal from the preparation plant and which is blown over with just sufficient air to keep the line clean. The main line is fabricated from spiral lock-seam steel 8-inch pipe and is carried over head from the coal preparation plant into the foundry building where the different branches radiate toward the furnaces.

Supplementary Air

Secondary air or air required for actual combustion is taken through the cone connecting the supply pipe with the exhauster as shown in Fig. 4. The outer end of the cone is provided with a 4-disk gate which may be adjusted at any point to insure the intake of a definite volume of air. The air and pulverized coal pass through the carburetors and enters the furnace firing chamber thoroughly mixed and in the proper proportion for generating a flame with a temperature sufficiently high to melt the charge.

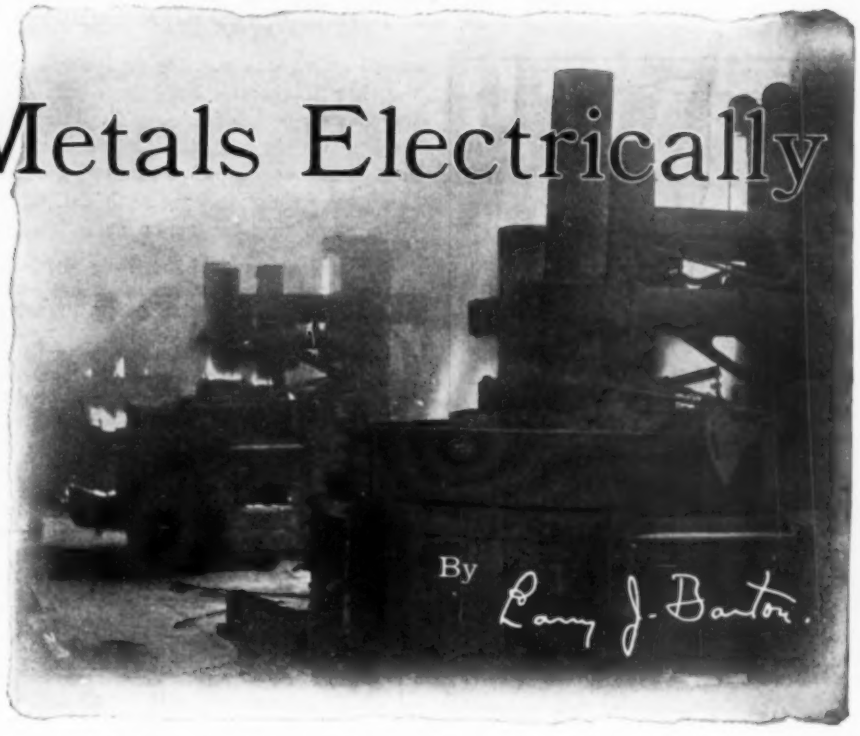
Part of the coal preparation plant is shown in Fig. 6. The four hoppers in the background supply coal to the exhausters which in turn drive the coal into individual lines leading to the melting furnaces. The tank to the right, mounted on a scale has a capacity of 5 tons and discharges through a 4-inch line into a pair of hoppers located close to the core ovens. Each supply of coal received in the tank is weighed and in that manner an accurate check is kept on the coal consumed in the annealing operation. In addition to the coal burned in the plant the American Radiator Co. ships a carload of pulverized coal every day to other foundries where it is mixed with the facing sand.

Among the claims advanced for this method of burning coal over those usually employed are that it promotes a cleaner atmosphere on account of the absence of smoke in the foundry and outside. It is stated the method shows a saving in coal, time and labor. It produces hot iron, insures tapping on a definite schedule and thus reduces the amount of scrap produced. The uniform conditions under which the furnaces are operated enable the furnaceman to more nearly approach uniformity in chemical and physical requirements.

Issue Publication on New Blacking

The S. Obermayer Co., Pittsburgh, has placed on the market a blacking, which is sold in the paste form, and has issued a pamphlet describing the manufacture of this paste together with the method of preparing the blacking for use. The various outstanding features of this blacking also are described.

Refining Metals Electrically



Chapter II (Concluded)

Making the Side Walls — Increasing Electrode Life —Over Charges

THICKNESS of the side walls is another feature of furnace detail upon which a considerable difference of opinion exists. A few years ago the writer was in charge of a new shop where a 6-ton Heroult furnace had been installed. In the first bricking up of the walls the standard of the U. S. Steel Corp., using 18-inch walls was followed. During the operation of the furnace, it was noticed that the inside course of brick rapidly gave way opposite the arcs, allowing the upper tiers of brick to fall into the hearth. After this first 9 inches of brick was gone, the remainder gave an exceptionally good life.

With this phenomena in mind, experiments were made over an extensive period to determine what thickness of side wall was preferable under the operating conditions at this plant. The first series of tests covered 18-inch walls, the brick being laid in different ways.

In the first test, brick were laid absolutely dry, standard key silica brick being used, laid end to end. No particular expansion allowance was made, the brick being loosely laid in place. After the first two heats all expansion was taken up and the faces of the brick had run together nicely binding the entire wall into one homogeneous mass.

The inside arch course over one door dropped on the heat No. 31. On heat No. 42, the inner course behind the rear electrode was burned through and the brick above it fell into the furnace. On heat No. 46, the entire inner course had failed, a great portion of the brick falling into the bath due to a loss of their foundation. Some of these brick were 4 to 5 inches thick. The remaining 9 inches of brick ran for 86 additional heats, until a hot spot developed on one wall necessitating a shut down for repairs. The total number of heats from this lining was 132 or 858 tons of metal.

On the second test, brick were laid in the same manner with the exception that the two courses were cemented together using a stiff mud made of fire clay and sodium silicate. The entire first course held in place a little longer going in over a period from the 27 to 51 heats. The arches held in place extremely well only dropping after the jambs had fallen. The total life of the complete lining was 119 heats or 774 tons.

On the third heat magnesite brick were used opposite each arc, a patch about 18 inches square being used. The inside course lasted for 68 heats, the first failure occurring at the arches and jambs due to burning away. The magnesite held up well, but as the silica brick surrounding them burned away, they spalled enough to keep the wall even. The entire lining lasted for 182 heats or 1183 tons.

Carborundum brick were used opposite each arc for the inner course on the fourth test. These were laid on the magnesite brick and silica brick run from above them to the roof. When the inner course of silica brick had been completely eaten through, the magnesite underneath had been about 50 per cent consumed, while the carborundum brick had eaten away approximately 1 inch. In this light the apparent ratio of the resistance of the three classes of brick would be carborundum, 1, magnesite, 5, and silica, 9. However, as soon as the magnesite course supporting the carborundum brick had failed, these brick were lost, due to falling in the bath and slagging away, and much of their value was needlessly lost. The total life of this wall was 170 heats or 1105 tons.

The next series of tests covered walls laid 9 inches thick, using silica brick straight, silica brick with magnesite patch opposite the electrodes, carborundum patch, etc. Lifes varying from 75 to 125 were obtained from such walls, those using the carborundum patch giving the longest service.

From our data, we derived the fact that a 9-inch wall gave superior life to an 18-inch section, and that a small patch of highly refractory brick opposite the weakest point, *i.e.*, where the arc impinged on the refractory, increased the length of life considerably.

A similar series of experiments was conducted by another firm covering a comparison between silica brick and a metal covered magnesite brick. It was found that the latter not only gave a much longer life, and proved cheaper, but that the quality of the product was bettered by the elimination of silica combining with the basic slags, and destroying their effectiveness. A strong

What Is Economy?

IN COMPLETING his discussion of building the side walls, the author relates results of comparative tests of different types of brick. Electrode economy is promoted by care in handling between charges, by proper attention to the joint where the electrodes enter the furnace and by cooling. A tight joint lengthens the service and care in charging is deemed imperative. Some believe in working a furnace beyond its rated capacity, by increasing the charges to the greatest possible extent. Comparisons are drawn which tend to show that in acid operation, adhering to rated charges makes for economy. In the forthcoming instalments, the melting of plain carbon steel will be explained.

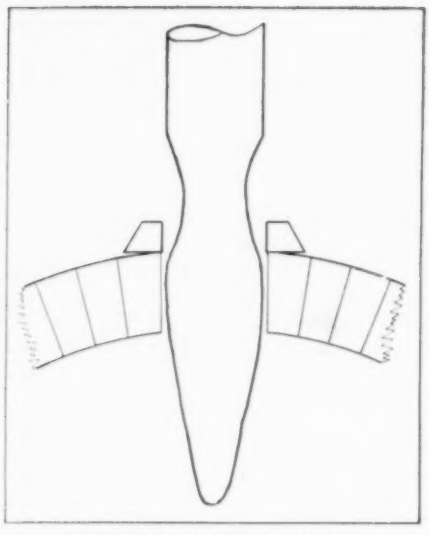


FIG. 17—RAPID BURNING RESULTS IN SPINDLING LEAVING A STUB WHICH QUICKLY IS BROKEN

er lime slag was obtained with its attendant better desulphurizing qualities.

On acid furnaces, the thickness of side walls is not so important as the banks are kept well up and the life of the brick is great. Such walls require only a small amount of patching periodically, and usually only on the two or three upper courses under the roof ring. On acid lining, several inches of some high heat insulator between the bricks and the shell increases the lip. Any increased burning of the face of the bricks, due to the higher temperatures and decrease of radiation easily may be overcome by throwing the patching material up against the walls. Such heat insulators as asbestos, diatomaceous earth, and several patent compounds prove to be thoroughly satisfactory for this purpose.

Care of Electrodes

IN ELECTRIC furnace work, the consumption and cost of electrodes is an important item. Whether carbon or graphite is used, an attempt should be made to obtain as near 100 per cent service from each pound as is possib'e. The greatest loss in the effective consumption of electrodes is caused by undue oxidation, which is especially troublesome in shops making intermittent heats. After the last heat of the day has been poured, the electrodes are in a highly heated condition for a length of approximately 4 feet. This red hot carbon, when exposed to the air over night, is heavily oxidized, a larger ash ½ inch thick often scaling off next day. This loss is extremely hard to prevent, but certain steps may be made to lessen its effect.

When the furnace is shut down over night two methods of handling the electrodes may be followed. They may be raised as high as possible or lowered into the hot furnace. Exponents of both methods will be found. The National Carbon Co. in a handbook on electrode care and operation, advocates raising them out of the furnace as high as possible, explaining the action as follows:

Various attempts have been made to prevent this destructive oxidation—such as the use of nonburning paints or asbestos coatings on the electrode, or by cooling with a salt water spray immediately after the last heat of the day. However, the most practical means of combating this feature seems to be that of raising the electrodes as high as possible out of the furnace and luting up the clearance between the roof glands and elec-

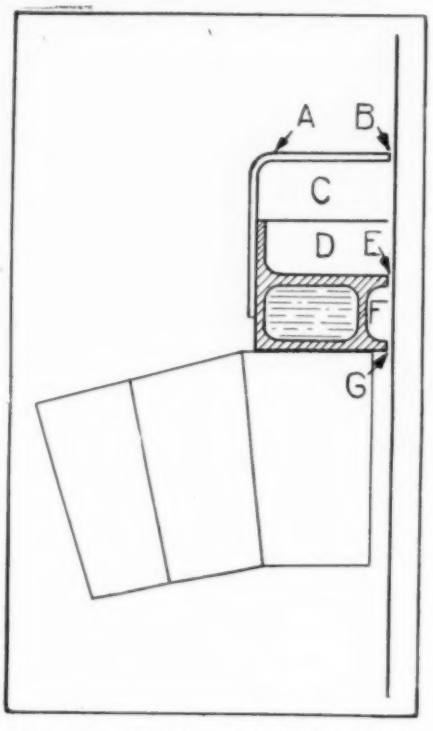


FIG. 18—SPECIAL, WATER-COOLED GLAND DESIGNED TO REDUCE BURNING OF ELECTRODES AT THE POINT OF ENTRY TO THE FURNACE

trodes with fire clay. This prevents the heat of the furnace from passing up and around the electrodes, and they will cool rapidly in the air with little oxidation. When running on one shift a day, this method has resulted in a saving of about 20 per cent in electrode consumption.

It has not proved advisable to lower the electrodes into the furnace and attempt to obtain a reducing atmosphere by throwing in a little coal and stopping out the air. Air will leak in through cracks in the fire clay and between the brick in the roof and walls as the furnace cools and contracts, and the heat of the furnace keeps the electrodes up to oxidizing temperatures for a long time.

The writer has tried both of the foregoing methods thoroughly to determine, if possible, which is superior. It was found that as regards the loss in weight, both were about equal in most cases, but with furnaces having close fitting doors, the balance was in favor of lowering the electrodes into the furnace, due to the fact that a certain amount of heat thus was conserved. The practice in most shops is to charge as soon as the heat is poured which makes the raising of the carbons mandatory.

Loss By Burning

Another great loss is caused by undue burning above the roof glands, or *spindling* as it is commonly known. When the heat first melts down, the electrodes dig low into the furnace and heat so that when the height of the bath rises, there is about a foot of red hot electrode exposed to the air. Then the hot gases rising around the electrode from the roof ports keep this portion at a high temperature. The result is a rapid burning as shown in Fig. 17 with the result that the electrode is weakened later causing the stub to break off. The loss in effective carbon from this cause is considerable and many methods have been devised to combat it.

Paints and coverings all have proved to be unsuccessful and much experimenting has been done along the lines of more effective roof glands. A roof gland is a water cooled ring surrounding the electrode where it enters the roof, the clearance between the ring and the electrode being as small as possible. The hot gases as they rise must pass through this small aperture, the attempt being to cool them down to a point where they will not ignite when entering the air. Figs. 18, 19 and 20 show different methods of applying this cooling principle.

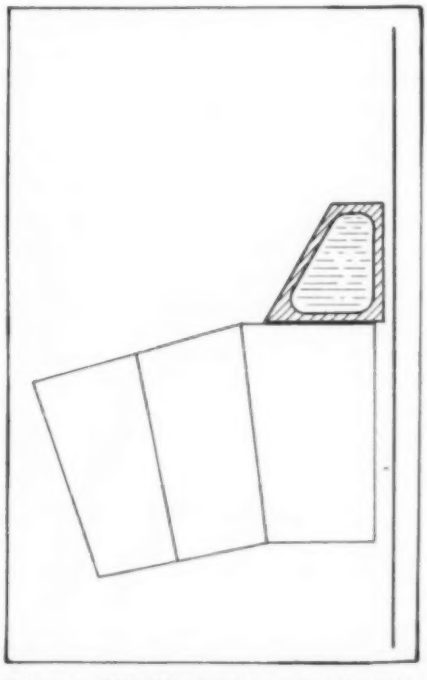


FIG. 19—WATER-COOLED RING CONSTRUCTED TO LOWER TEMPERATURE OF ELECTRODE

The ring shown in Fig. 18 is a patent gland designed by the Electric Furnace Construction Co., Philadelphia, makers of the Greaves-Etchell type furnace. Fig. 19 is that used on the 'Lectromelt furnace made by the Pittsburgh Electric Furnace Corp., Pittsburgh, and Fig. 20 is the type of ring used on the Heroult furnace. In the older methods, straight water cooling was the only means attempted to lower the burning of this gas, while in newer types the rings are used to lower the velocity and temperature of the gas by permitting an expansion.

Principles Explained

The principal of the device shown in Fig. 18 is as follows: The superheated gas with a high velocity enters the economizer at *G*. Here the first expansion is allowed, together with the first cooling operation. The large area, *F*, permits this gas to expand, losing its velocity, with the result that the period of water cooling is greatly increased. The semi-cooled gas then passes through the small clearance into the large chamber, *D*, where the expansion is such as practically to eliminate any velocity. Further cooling is here made possible. The gas then rises through a fine wire screen into another expansion chamber, *C*, where the last vestige of velocity is removed, the cooled gases gradually working their way out of the cover, *A*, at the opening, *B*.

Another reason for undue burning is the poor contact at the electrode joints, causing resistance to the flow of the current. Naturally, this heats the spot and the result is a red hot patch from 1 to 4 inches in diameter, depending on the lack of contact. As soon as this point burns away slightly, a clearance is formed, and a small arc is drawn If too severe, the electrode nipple will be cut cleanly off allowing the bottom electrode to drop in the bath. Whoever has had to get up on a hot furnace and try to pull out an entire stub, broken off even with the roof, knows the labor, loss, and delay of such an accident. The remedy is to maintain tight joints.

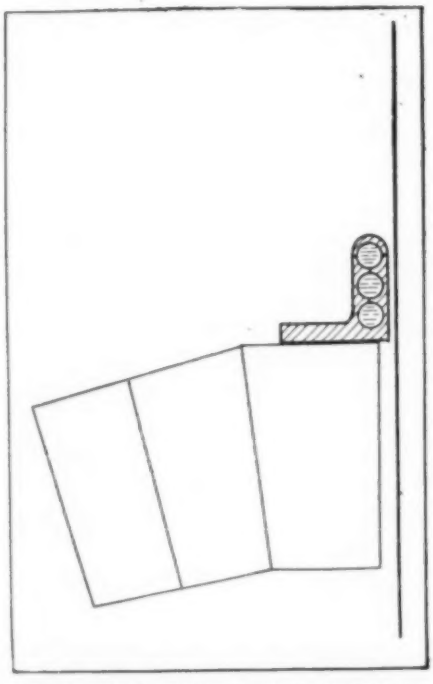


FIG. 20—ELECTRODE RING WITH MULTIPLE DUCTS FOR CONDUCTING THE COOLING WATER

The vibration of the furnace always tends to loosen a joint and they should be tightened after every heat. The best way to do this is to obtain a standard chain pipe wrench about 25 inches long, and have a double length chain placed on. With this simple instrument an electrode may be tightened in about 5 seconds, and made so tight that there is no possibility of a bad joint. In making joints, plenty of electrode compound should be used so that when the joint finally is tightened the compound will ooze out, filling all microscopic cracks of openings.

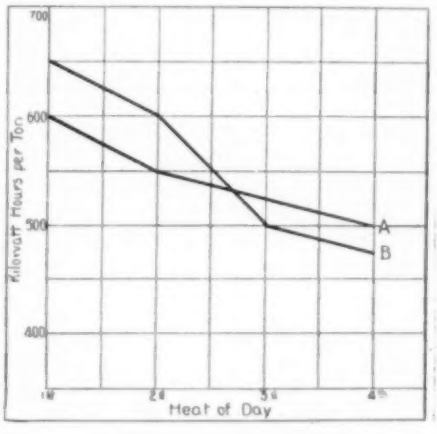


FIG. 21—POWER CONSUMPTION OF THREE-TON ACID-LINED FURNACE OVER A PERIOD OF ONE YEAR—CURVE A WAS DEVELOPED FROM OVERSIZE HEATS AND B FROM RATED CHARGES

The greatest care always should be used to avoid any careless operation which will result in electrode breakage. When the furnace is being charged, the electrodes should be raised well up out of the line of scrap so that there is no danger of a piece being thrown against the tip where weakness is greatest. When the scrap is melting and falling in, it is safe to raise the electrodes and poke in the metal around them until a clear pool is formed. This avoids any chance of a body of scrap falling against and breaking an electrode. The automatic regulators always must be watched to prevent any trouble causing *racing* which is likely to cause an electrode to break off by allowing it to strike heavily against the charge.

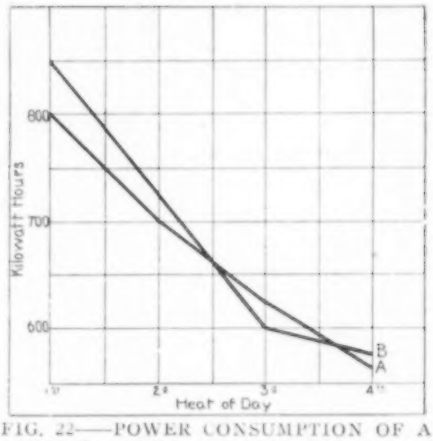


FIG. 22—POWER CONSUMPTION OF A SIX-TON BASIC LINED FURNACE—CURVE A WAS PLOTTED FROM HEATS RUNNING NOT MORE THAN 1000 POUNDS OVER RATED CAPACITY AND B FROM MUCH LARGER HEATS

Economical Operation

THE size of heats which should be made furnishes another point upon which there is considerable difference of opinion. When a 3-ton furnace is built, it always is constructed so that an overload of 100 per cent may be had if necessary. This leads to the production of oversize heats, charges of from 4 to 5 tons being the standard. This practice is similar on all sizes and types of furnace, the idea being that an oversize heat is a great deal more economical to make than a standard heat.

While in general it is desirable to run larger heats due to the larger tonnage, proportionally less operating time, etc., it does not always follow that this practice is the most economical. Other features should be considered such as tied up floor space, rapid flask turnover, size of equipment, etc., all of which favor smaller heats.

The main point at issue is the difference in power per ton necessary, and the consequent difference in conversion costs, of the two methods.

Some light may be thrown on this subject by an examination of the two curves covering both acid and basic operations as shown in Fig. 21 and 22. Fig. 21 covers the record of one year's operation of a standard 3-ton 'Lectromelt furnace, operating on the acid hearth, and producing steel for medium size steel castings. Operations usually covered three heats per day steadily, although there were days when four were made, and many days when only two heats were poured. The work was as is found in any jobbing shop, the size of the work to be poured generally determining the size of heat necessary. On the larger heats the temperature of the metal was less than on the standard size heats, due to the larger castings being poured with metal as cold as was consistent with safety. Consequently the

Table XIX

Operating Figures in Various American Shops

Make of furnace	Size heat Tons	Operations Hours	KwH per ton	Time-heat Hours and Minutes	Electrode cons. per ton	Life of roof Number of Heats	Life of walls Number of Heats
Basic Operations							
Heroult	3 to 5	12	850	5	30 lb. Carbon	75	75
Heroult	6 to 8	12	650	5 to 6	28 lb. Carbon	225	200 to 250
Gronwall-Dixon	3	8	760	3 to 4	21 lb. Carbon	150	200
Heroult	3 to 5	16	800	4 to 5	28 to 30 Carbon	75	225
Greaves-Etchell	6	8	900	4 to 5	57 Carbon*	129	129
Rennerfelt	1	8	787	2:45	14 Graphite	90	195
Greaves-Etchell	1	8	900	2:30	15 Graphite	160	120**
Webb	3	24	600	2:45 to 3	6½ Graphite	100	100
Booth	2¼	8	1450	3:30	.....	..	..
Greene	2	16	730	2:15	15 Graphite	75	150
Heroult	6	24	575	3:00	22 Carbon	125	250
'Lectromelt	3	8	700	2:30	28 Carbon	75	125
Acid Operations							
'Lectromelt	3	8	780	1:00	32 lb. Carbon	110	300
'Lectromelt	3 to 4	8	570	1:15 to 1:45	18 lb. Carbon	75 to 100	300 to 400
Greene	2½	8	850	3:00	40 lb. Carbon	142	142
Greene	2	8	700	2:30 to 3:00	15 Graphite	146	146
'Lectromelt	1½ to 2	8	520	1:00	14 Graphite	300	500
Rennerfelt	1	8	700	2:30	20 Graphite	100 to 200	560
Heroult	4	10	650	1:45	15 Graphite	..	..
'Lectromelt	3	8	660	2:30	30 Carbon	50	100
Greene	1½	8	800	3:00	.....	..	..
Greene	2 to 3	8	700 to 800	3:00 to 4:30	10 Graphite	100	100
Heroult	2½	8	635	2:30	16½ Graphite	175	175

All of the figures were given the writer by the superintendents of the various foundries, and naturally show a great variation. However, the general trend of results clearly is shown.

* This figure is either a mistake or indicates wretched practice.

** It is unusual to obtain a longer life from a roof than a side wall, and if this is correct probably indicates a roof which has been patched up, or else trouble is being had with the walls failing.

figures tend to favor the oversize heat slightly, when viewed from this angle.

Curve *A*, is that developed from oversize heats, those running from 7000 pounds up. Curve *B* shows figures obtained on heats under this figure. These curves show strong superiority for the large heat on the first two heats of the day, but favor the small heat for continuous operations. This is probably due to the time necessary for charging, the shorter time necessary for the smaller heat being sufficient to eliminate a great amount of the lost heat from radiation.

Fig. 22 covers the operations of a 6-ton Heroult furnace over a two-year period, using the basic process, making steel for castings and high grade ingots, the operation being over the 24-hour period. Curve *A* is developed from heats of under 6½ tons, while *B* covers the larger sizes. The difference on the basic process does not appear to be so marked as on the acid hearth, probably due to the fact that the amount of heat necessary for the slags tends to stabilize any small melting differences.

Other operators have reported results differing greatly from those given, some reporting savings of as great as 15 to 20 per cent by melting oversize heats. There is no question but that the larger heats are in the end slightly cheaper, as the proportional time is less on the heavy charges. Consequently, the wear and tear on the furnace roof and walls, and the electrodes and ladles is less which may prove to be a considerable item at the end of a year's operation.

Continuity of operations is most desirable in an electric furnace shop. The curves aptly show the great drop in power used as the number of heats produced rises. Therefore, it is better to make two heats every other day than to make one daily, if the other shop conditions, will warrant such action.

Steam Cause of Trouble

Question: We are experiencing a considerable amount of trouble with small gear blanks 2 inches in diameter, 1 inch face. These blanks are machined all over the surface and drilled for a ½-inch shaft. Apparently they are solid when cast but a cut over the cope side discloses a mass of small cavities, ranging in size from a pea to the head of a pin. Usually a shrink hole is exposed about half way through the center after the ½-inch hole has been drilled. The remainder of the casting finishes up perfectly clean.

Answer: The cavities are caused by steam in the mold and the steam is due to faulty molding practice. You easily may determine this point for yourself by pouring one of the molds without a cope. You will note that the iron flutters while the mold is filling. With an open mold all the steam may escape before the iron solidifies, but under a cope a thin film forms immediately after the mold is filled and some of the steam remains trapped in the iron. The trouble may be induced by any one or a combination of several factors including: Wet sand, hard sand, close sand or patterns set too closely together. Knowing the temptation which prompts every foundryman to crowd as many patterns as possible into a flask, we are inclined to the opinion that is the cause of the trouble in your case. Space your patterns a reasonable distance apart so that the steam has a chance to escape between them, vent between them with a wire for the same reason if your sand is inclined to be close and you will have no further trouble. A more economical method for making these small gear blanks is to cast long blanks in a vertical position and cut sections from them.

Plan New Foundry

The Walton Foundry Co., Inc., Walton, N. Y., is planning the erection of new foundry buildings on a new and larger site. The plans call for a molding floor of about 4000 square feet, and in addition a cleaning room and a machine shop with a floor area of about 1800 square feet, located as handily as possible to the foundry. The company has about 150 feet of track.

Foundrymen Entertained

Members of the New England Foundrymen's association were the guests of the Providence Gas Co., Providence, R. I. Aug. 20. The party left on the steamer, and after inspecting the plant of the gas company, sailed down Narragansett bay to Newport, R. I. An exhibition of torpedo firing was given and the party inspected the naval torpedo base and the training station at Newport, R. I. The party returned to Providence for a banquet and entertainment at the Biltmore hotel.

Report on Molding Sand Tests

Joint Committee on Molding Sand Research Gives Tests for Determining the Fineness and Dye Adsorption Properties and Presents Methods for Sampling Shipments of Sand

SLIGHT changes have been made in the fineness test for molding sand originally announced at the Cleveland convention of the American Foundrymen's association, May 1, 1923, by the joint committee on molding sand research. These changes have been made to conform to revisions in standard specifications for sieves made by the United States bureau of standards and announced in April, 1924, since from the beginning of study on this test the committee has desired to incorporate in the requirements for determining the fineness of molding sand only those tolerances acceptable to the bureau of standards. The principal revision permits considerably larger tolerances for wire diameter than those previously used, which changes the dimensions and tolerances for sieves.

The dye adsorption test, as presented in a recent report of the joint committee, is the same as was presented at the Cleveland convention. The application of the dye adsorption phenomenon to molding sand is for the purpose of ascertaining the nature of the clay substance present. Different sands possess widely different adsorption capacities, and this difference is due to the quantity of colloidal matter present. The colloids in molding sands mostly are of an inorganic nature; hydrated aluminum silicate, hydrated iron oxide, hydrated silicic acid and other hydrated minerals. All of these constituents are of a gelatinous and sticky nature and impart to the sand the property of bond. Strongly bonded molding sands commonly possess clay substance that is high in colloid content as measured by the dye adsorption test. The weaker bonded sands generally show a lower dye adsorption figure corresponding to a smaller quantity of colloids present in the clay substance of those sands.

The method of sampling reported by the committee tends toward the standardization of this procedure, and in case of disputes on shipments will prove valuable, since it is a means of obtaining a uniform and representative sample of the shipment. The details are practically the same as applied to the shipments of coal, and the method has proved reliable and practical.

The tentatively adopted methods for making the fineness tests, determining the dye adsorption properties and sampling shipments of sand are given in the following articles. The tests for molding sand which heretofore have not been published in THE FOUNDRY will appear in the Sept. 15 issue.

Series of Sieves Determines Fineness

TESTS have been adopted tentatively to determine the fineness of two kinds of molding sand. The procedure for testing molding sand containing no clay or bonding material is as follows: One hundred grams of sand which has been dried for at least 1 hour at a temperature not lower than 105 and not higher than 110 degrees Cent. are transferred to the first of a series of sieves, United States bureau of standards Nos. 6, 12, 20, 40, 70, 100, 140, 200 and 270, and are placed in a Ro-Tap testing sieve shaker or other machine which may yield the same results. The machine is run for 30 minutes and the amount of sand remaining in each sieve is weighed and expressed in percentages. The portion passing the No. 270 sieve is known as No. 270 minus.

The procedure for conducting the fineness test for molding sands containing clay of bonding substance is as follows: Fifty grams of molding sand which has been dried for at least 1 hour at a temperature not lower than 105 and not higher than 110 degrees Cent. are put into a one quart bottle or preserving jar. The 50-gram sample is used since the 100 gram sample involves so many siphonings as to make the test prolonged. The bottle used should be smooth on the inside with no sharp shoulders in the neck to permit the sand to be removed easily with a small stream of water. Four-hundred and seventy-five cubic centimeters of water and 25 cubic centimeters of a standard solution of sodium hydroxide, made by dissolving 10 grams of sodium hydroxide in 1000 cubic centimeters of water, are added and the bottle or jar is covered and securely sealed. In using a preserving jar a rubber disk is employed instead of the usual rubber ring. The rubber disk fits into the inside of

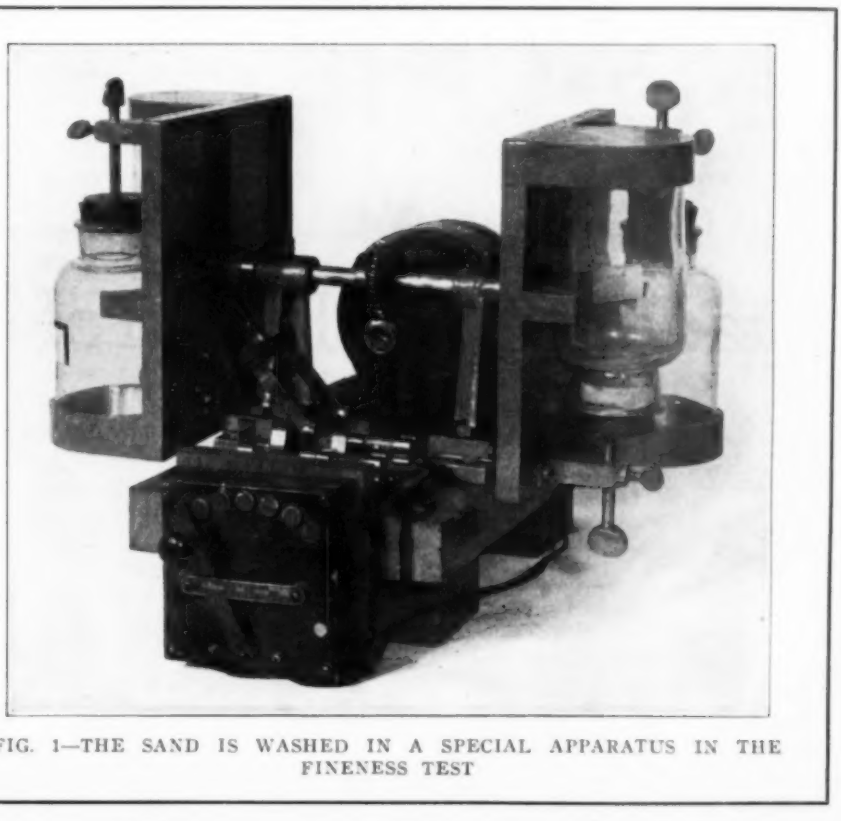


FIG. 1—THE SAND IS WASHED IN A SPECIAL APPARATUS IN THE FINENESS TEST

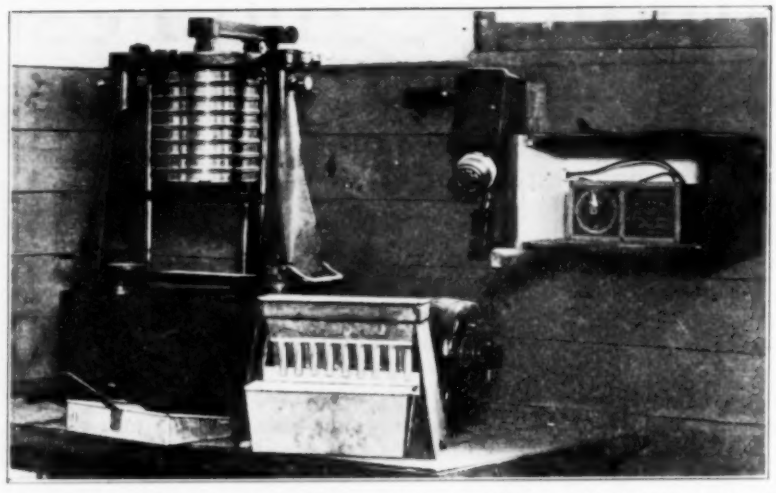


FIG. 2—TESTING SIEVE SHAKER SAND SCREENS AND TIME SWITCH USED IN CONNECTION WITH THE FINENESS TEST

the glass cover instead of on the outside of the jar.

The receptacle then is placed in a shaking machine, which makes about 60 revolutions per minute, in such a way as to allow it to be upended at each revolution. At the end of 1 hour the receptacle is removed, the cover unsealed and the sand adhering to the cover washed into the receptacle. The receptacle is filled with water, the stream being allowed to stir up the contents. The receptacle then is allowed to stand for 10 minutes after which the water is siphoned off by a siphon extending to within 2.5 centimeters, approximately 1 inch, of the bottom. Water again is added to fill the receptacle and at the end of 10 minutes is siphoned off. Water is added again and at the end of 5 minutes is siphoned off. The process of filling, allowing to stand 5 minutes and then siphoning, is repeated until the water remains clear at the end of the 5 minute period. In this way the clay substance is separated from the grain and may be collected in suitable containers and recovered by the addition of acid to neutralize the sodium hydroxide. This treatment has been found satisfactory for practically all American molding sands. However, there are some foreign sands that are alkaline which require an acid treatment, in which case tannic acid may be used.

After all of the clay substance has been removed, the grain remaining in the bottle or jar is washed on to a filter paper in a 9-centimeter Buchner's funnel, the water being drained by suction. The sand then is wet with alcohol and transferred, together with the filter paper, to a large glass and dried for ½ hour at a temperature not lower than 105 and not higher than 110 degrees Cent. The grain is weighted and the difference between its weight and 50 grams is ascertained to determine the clay substance. The filter paper may be disposed of, after drying, by burning, as it lies on top of the sand sample.

The grain then is placed in the first of a series of sieves, United States bureau of standards Nos. 6, 12, 20, 40, 70, 100, 140, 200 and 270. These sieves are placed in a Ro-Tap testing sieve shaker, or another machine which will yield identical results. The machine is run for 15 minutes, and the amount remaining on each sieve is weighed and expressed in percentage. The portion passing No. 270 sieve is known as No. 270 minus.

The revised series of sieves of the United States bureau of standards, which differ from those included in the fineness test reported at the Cleveland convention, is given in the accompanying table.

The fineness test may be graphically expressed by plotting sieve numbers as abscissa against the grain remaining on each sieve, calculated in per cent of 50 grams.

Revised Series of Sieves

Sieve Number	Sieve opening millimeters	Sieve Opening Inches	Wire diameter millimeters	Wire Diameter inches	Tolerance in average opening per cent	Tolerance in wire diameter per cent	Tolerance in maximum opening per cent
6	3.36	.132	1.02	.040	±3	—15 to +30	10
12	1.68	.0661	.69	.0272	±3	—15 to +30	10
20	.84	.0331	.42	.0165	±5	—15 to +30	25
40	.42	.0165	.25	.0098	±5	—15 to +30	25
70	.210	.0083	.140	.0055	±6	—15 to +35	40
100	.149	.0059	.102	.0040	±6	—15 to +35	40
140	.105	.0041	.074	.0029	±8	—15 to +35	60
200	.074	.0029	.053	.0021	±8	—15 to +35	60
270	.053	.0021	.041	.0016	±8	—15 to +35	90

Standardize Method of Taking Sample

PROPER samples of sand must be secured if standard results are to be obtained from the molding sand tests. For this reason, the joint committee has adopted a method for sampling sand as shipped or delivered.

The sample should be collected when the sand is being loaded into or unloaded from railroad cars, ships, barges, or wagons, or is being discharged from supply bins, industrial railway cars, grab buckets, or sand conveyors. In case the sand is crushed, or mixed by mechanical means, at the place of sampling, the sample should be collected after the sand has passed through the machine. Samples should not be collected entirely from the surface of sand in piles or bins, or in cars, ships, or barges, as samples so collected generally are unreliable. A reliable and representative gross sample may be collected only by taking portions of sand from different parts of the mass, and such opportunity is afforded only when the sand is being transferred from one carrier to another—bank cars to railroad car, railroad car to barge, or wagon to bin, etc.

A shovel should be used for taking equal portions or increments to make up the gross sample, each portion or increment weighing 10 pounds. The increments must be collected regularly and systematically, so that the entire quantity of sand sampled will be represented proportionately in the gross sample, and they must be collected at such intervals that the gross sample will be of the required size. The gross sample should contain the same proportion of lump sand, fine sand, and impurities as the sand sampled. When sand is extremely lumpy, making difficult the collection of representative increments by shovel, a quantity of the lumps may be

broken and portions collected from the broken lumps.

The gross sample must not be less than 500 pounds. Whether the quantity of sand consists of 1 ton, 500 tons, or more, the need of the gross sample being of the size stated is the same.

Method of Sampling Sand

The number of gross samples that should be collected must vary for each consignment or shipment, and each case must be considered individually. For example, a shipment of 1000 tons, of 20 railroad cars of 50 tons each, may be represented by one gross sample of approximately 500 pounds, if properly collected; but in case sand from several pits enters the shipment and a separate gross sample from, say four cars to represent the sand produced by one bank is desired, or if for some other reason a sample is desired from four of the cars, then to represent the sand in the four cars a gross sample of 800 pounds should be collected by taking approximately 200 pounds from each car. If, for example, another sample for eight of the cars is required, then approximately 100 pounds should be taken from each car. The sampler should be instructed as the number of gross samples desired, or the number of cars, or the sand each sample is to represent.

As the shovelfuls of increments are taken, they are deposited on a clean, tight and smooth floor or placed in clean barrels, boxes, or other receptacles. The sample must be protected from rain, snow, wind or beating sun. Cinders, chippings from the floor, or any other foreign matter must not get into the sample. Boxes, barrels, buckets or other receptacles should be inspected each time before using to insure that they are clean.

Shovelfuls of sand may be collected from every wagon, or from every second or third wagon as the sand is being loaded or unloaded from the wagon, the number of shovelfuls and the number of wagonloads sampled depending on the number of loads that the gross sample is to represent. If the sand is unloaded by shovel, the shovelfuls for the sample should be taken from different parts of the wagon of wagons, but they should be taken from similar points, as from the surface or the ends of the loads or from the last sand remaining in the wagons. If dump wagons are used, the sample may be taken as the sand flows from the wagon, care being taken not to take shovelfuls from the first or the last sand running.

In carload sampling, the number of shovelfuls or increments of sand required to make up the gross sample should be collected from different parts of the car or cars, from the top to bottom and from end to end, while the sand is being loaded or unloaded.

When sampling a shipment of bank sand, the shovelfuls or increments should be taken systematically and regularly as the sand is loaded in railroad cars so that the gross sample will represent the entire quantity sampled. The frequency of collecting the increments will depend on the number of cars of sand to be represented by the gross sample. If only one railroad car is to be sampled, the number of shovelfuls required to obtain a gross sample of the required size should be collected from each unit dumped. In case the car is filled by conveyor or chute, increments should be taken at intervals in that proportion which the total number of increments bears to the total loading time. If two or more cars of sand are to be represented by one sample, the gross sample should be collected by taking a shovelful of the sand dumped from each bank car or from every second, third, or fourth, etc., unit, to have a gross sample of proper size, so that representative portions of sand will be taken in equal quantities from each car. If the railroad cars differ in size, the quantities taken from each car should be in proportion to the capacities of the cars. When sand is dumped from units into railroad cars, the lumps usually roll to the bottom, hence shovelfuls should not be collected entirely from the bottom of the car, but should be taken systematically over the surface of the sand.

Sampling Sand from Cars

In sampling sand being unloaded by shovel from cars, the shovelfuls to make up the gross sample should be taken at regular intervals. Workmen unloading sand usually begin by shoveling the sand out to the bottom to faciltate shoveling from the floor. As a result the load is exposed from top to bottom and an excellent opportunity is afforded for taking shovelfuls for the sample from different places in the face exposed as unloading progresses, and it is easy to obtain a final sample composed of shovelfuls from all parts of the load, from top to bottom and from end to end.

In sampling sand from dump cars, shovelfuls may be taken from the stream of sand being discharged, care being observed not to collect portions of the first or last sand spilling from the car. Because of the suddenness with which sand may drop out of a railroad car and because of the momentum of the rapidly falling mass, the collection of a satisfactory sample by attempting to catch shovelfuls may be impossible. In such event it may be necessary to collect shovelfuls of sand that has overflowed on the pier or the trestle deck or the sides of pockets. If beams 10 to 12 inches wide span the pockets immediately underneath the car a fairly satisfactory sample may often be collected in shovelfuls from the sand lodging on the beams.

Ship or Barge Sampling

In sampling a ship or barge, as in sampling a car, portions of sand should be taken in equal quantities and at frequent and regular intervals while the sand is being loaded or unloaded, so as to represent proportionate parts of the whole consignment. If the sand is unloaded by grab buckets, or into barrows or sand-conveying equipment, shovelfuls usually may be advantageously collected at regular intervals from the buckets, barrows or equipment.

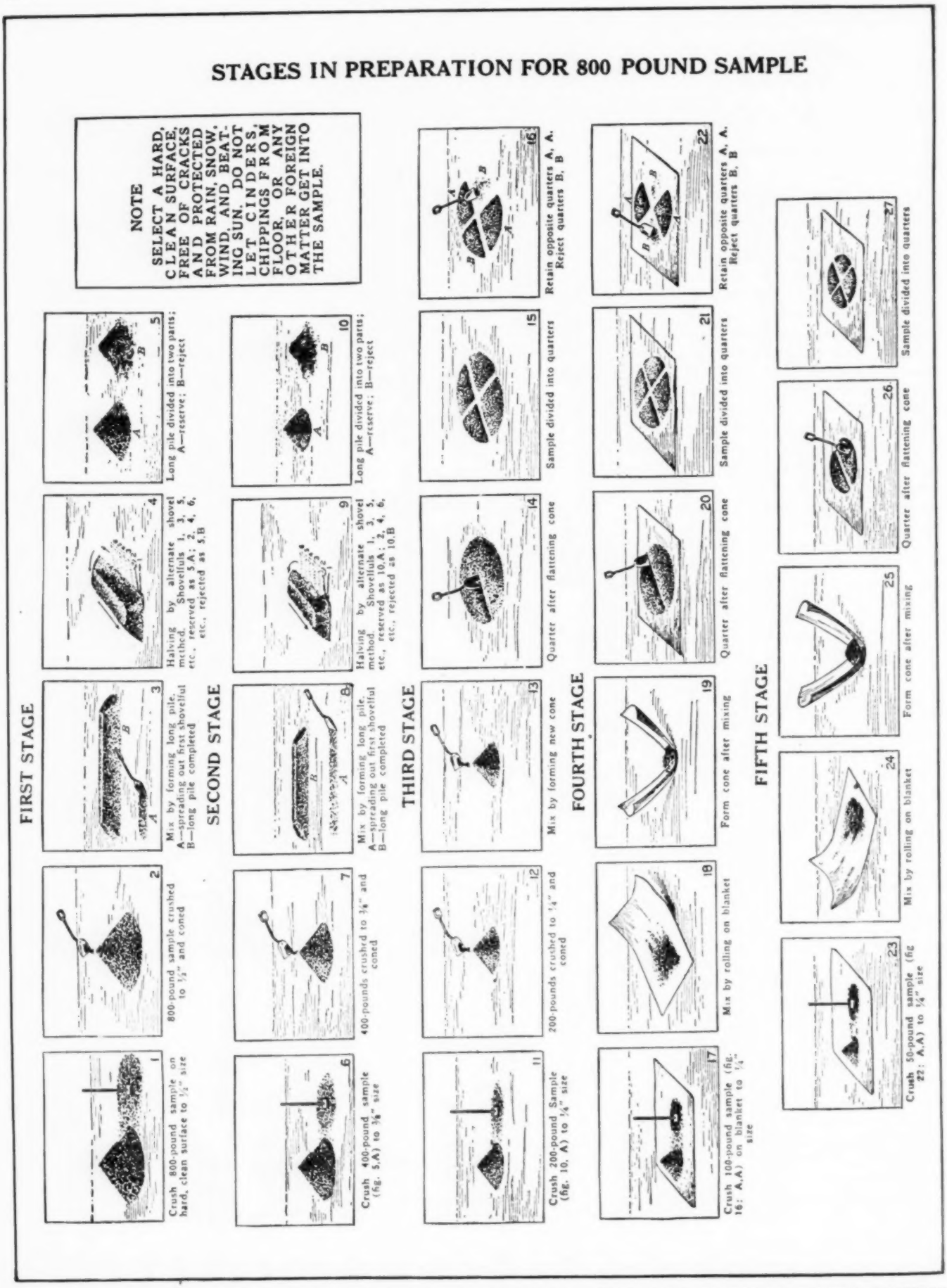
After the gross sample has been collected, lumps must be broken up, the sand must be systematically mixed, and reduced to convenient size for transmittal to the laboratory. The lumps may be broken with a hardwood tamper. If a suitable tamper is not available, a satisfactory tamper may be made from a piece of 6 by 6-inch timber, 12 to 15 inches long, by boring a suitable hole in one end and inserting a handle about 3 feet long and 1½ to 2 inches in diameter. The handle should fit the hole snugly. By splitting the end to be inserted and loosely placing a wood wedge therein the handle will be firmly held in place when driven home.

Lumps should be broken on a smooth, clean, sheet-iron plate of suitable dimensions or on a solid floor. If a suitable plate or floor is not available, the work may be done on a heavy canvas. In preparing the sample, care must be taken that no pieces fly out of it, and that no cinders, chipping from the floor, or any other foreign substances are allowed in. Samples are prepared of the weight indicated in the following table so that no lumps of sand will be greater in any dimension, as judged by the eye, than specified for the sample before division into two approximately equal parts as follows:

Weight in pounds of sample	Largest sizes of lumps allowable in samples before division. Inches
800	½
400	⅜
200	¼

The method of reducing by hand the quantity of sand in a gross sample must be carried out as prescribed, even though the coarseness of the sand be less than is specified in the table. The progressive reduction in the weight of the sample to the quantities indicated in the table must be done by the following methods, which are shown in the accompanying illustration.

The alternate-shovel method of reducing the gross sample is to be repeated until the sample is reduced to approx-


STAGES IN PREPARATION FOR 800 POUND SAMPLE
NOTE
SELECT A HARD, CLEAN SURFACE, FREE OF CRACKS AND PROTECTED FROM RAIN, SNOW, WIND, AND BEATING SUN. DO NOT LET CINDERS, CHIPPINGS FROM FLOOR, OR ANY OTHER FOREIGN MATTER GET INTO THE SAMPLE.
FIRST STAGE
SECOND STAGE
THIRD STAGE
FOURTH STAGE
FIFTH STAGE
1 Crush 800-pound sample on hard, clean surface to ½" size
2 800-pound sample crushed to ½" and coned
3 Mix by forming long pile. A—spreading out first shovelful B—long pile completed
4 Halving by alternate shovel method. Shovelfuls 1, 3, 5, etc., reserved as 5.A; 2, 4, 6, etc., rejected as 5.B
5 Long pile divided into two parts; A—reserve; B—reject
6 Crush 400-pound sample (fig. 5.A) to ⅜" size
7 400-pounds crushed to ⅜" and coned
8 Mix by forming long pile. A—spreading out first shovelful B—long pile completed
9 Halving by alternate shovel method. Shovelfuls 1, 3, 5, etc., reserved as 10.A; 2, 4, 6, etc., rejected as 10.B
10 Long pile divided into two parts; A—reserve; B—reject
11 Crush 200-pound Sample (fig. 10. A) to ¼" size
12 200-pounds crushed to ¼" and coned
13 Mix by forming new cone
14 Quarter after flattening cone
15 Sample divided into quarters
16 Retain opposite quarters A, A. Reject quarters B, B
17 Crush 100-pound sample (fig. 16: A.A) on blanket to ¼" size
18 Mix by rolling on blanket
19 Form cone after mixing
20 Quarter after flattening cone
21 Sample divided into quarters
22 Retain opposite quarters A, A. Reject quarters B, B
23 Crush 50-pound sample (fig 22: A.A) to ¼" size
24 Mix by rolling on blanket
25 Form cone after mixing
26 Quarter after flattening cone
27 Sample divided into quarters

METHOD OF PREPARING SAMPLE OF SAND BY HAND—THE NECESSARY TOOLS ARE THE SHOVEL, TAMPER, BLANKET MEASURING ABOUT 6 X 8 FEET, BROOM AND RAKE—THE SAND IS RAKED WHILE BEING CRUSHED, SO THAT ALL LUMPS WILL BE CRUSHED—THE FLOOR OR BLANKET IS SWEPT CLEAN OF DISCARDED SAND EACH TIME AFTER THE SAMPLE IS HALVED OR QUARTERED

imately 125 pounds. Before each reduction in quantity the sample must be crushed to the fineness prescribed in the table. The crushed sand must be shoveled into a conical pile (Figs. 2 and 7) by depositing each shovelful of sand on top of the preceding one, and then formed into a long pile in the following manner: The sampler takes a shovelful of sand from the conical pile and spreads it out in a straight line. (Figs. 3*A* and 8*A*), having a width equal to width of the shovel and a length of 4 to 6 feet. His next shovelful is spread directly over the top of the first shovelful, but in the opposite direction, and so on back and forth, the pile being occasionally flattened until all the sand has been formed into one long pile, (Figs. 3*B* and 8*B*).

Half of the pile thus formed must be discharged in the following manner: Beginning on one side of the pile, at either end, and shoveling from the bottom, the sampler takes one shovelful, shovelful No. 1 Figs. 4 and 9, and sets it aside; advancing along the side of the pile a distance equal to the width of the shovel, he takes a second shovelful, shovelful No. 2, Figs. 4 and 9, and discards it; again advancing in the same direction one shovel width he takes a third shovelful, shovelful No. 3 Figs. 4 and 9, and adds it to the first. Shovelful No. 4, Figs. 4 and 9, is to be taken in a like manner and discarded, the fifth shovelful, No. 5, Figs. 4 and 9, retained, and so on, the sampler advancing always in the same direction around the pile, so that its size will be reduced gradually and uniformly. When the pile is removed about half of the original quantity of sand should be contained in the new pile formed by the retained shovelfuls, Figs. 5*A*, and 10 *A*, show the retained halves, and 5 *B* and 10 *B*, the rejected halves.

After the gross sample has been reduced by the above method to approximately 200 pounds, further reduction in quantity must be by the quartering method. Before each quartering the sample must be crushed to the fineness prescribed in the table. Quantities of 100 to 200 pounds must be thoroughly mixed by coning and reconing, Figs. 12 and 13; quantities less than 100 pounds must be placed on a suitable cloth, measuring about 6 by 8 feet, thoroughly mixed by raising first one end of the cloth and then the other, Figs. 18 and 24, so as to roll the sand back and forth, and then formed into a conical pile by gathering together the four corners of the cloth, as shown in Figs. 19 and 25.

Quartering of the conical pile must be done as follows: The cone is flattened by pressing its apex vertically down with a shovel or board, so that when the pile is quartered each quarter will contain the material originally in it. The flattened mass, which must be of uniform thickness and diameter, is then marked into quarters, Figs. 14, 20 and 26, by two lines that intersect at right angles directly under a point corresponding to the apex of the original cone. The diagonally opposite quarters, *B*, *B* in Figs. 16 and 22, must then be shoveled away and discarded and the space that they occupied brushed clean. The sand remaining must be successively mixed, coned and quartered until opposite quarters shall equal not less than 12½ pounds of not greater than 4-mesh, size. Each of the 12½-pound quantities must be thoroughly mixed and placed in a container suitable for transportation to the laboratory.

Ascertains Nature of Clay Substance

DYE adsorption or the nature of the clay substance in molding sand is determined in the following manner. Twenty-five grams of molding sand, which has been dried for 1 hour at a temperature not lower than 105 and not higher than 110 degrees Cent., are weighed into a 500 cubic centimeter wide-mouth bottle fitted with a glass stopper, and 300 cubic centimeters of distilled water plus 5 cubic centimeters of a 10 per cent ammonium hydrate are added. The bottle is stoppered, sealed with paraffin wax, and rotated in a suitable machine for 30 minutes. Any machine making approximately 60 revolutions per minute and up-ending the bottle with each revolution is satisfactory.

At the end of the 30 minute period 90 cubic centimeters of distilled water are added plus 5 cubic centimeters of 10 per cent acetic acid. Crystal violet dye then is added in sufficient weight to allow the adsorption of the colloidal matter and to leave a slight excess. For molding sands of weak bond, 0.125 grams is a good amount to use at the start, while the stronger sands require an addition of 0.150-0.300 grams or more of dye. After adding the crystal violet, the bottle is sealed again and rotated for another 30 minute period. If all of the dye is taken up by the colloidal matter, more dye should be added, as it is necessary that an excess of dye be present over that required to satisfy the adsorption capacity of the colloids.

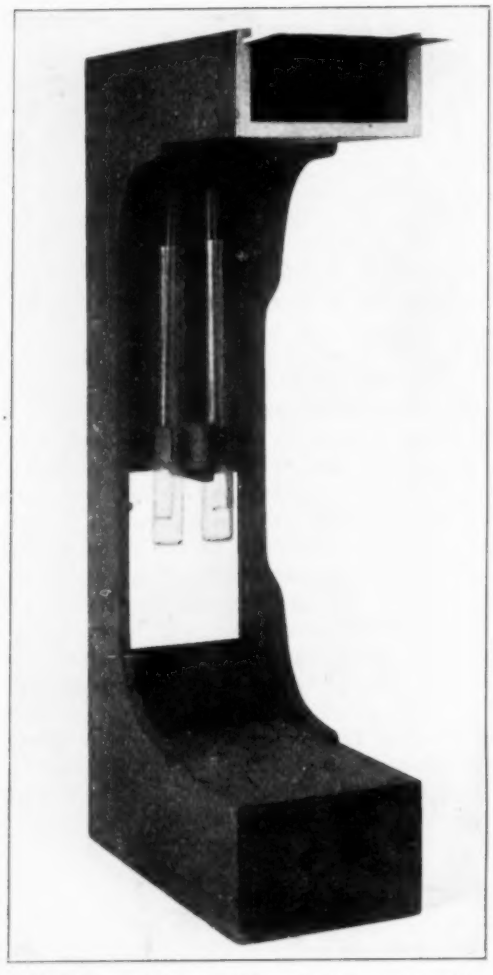
To determine the amount of dye adsorbed by the sand it is necessary to find the unadsorbed quantity held in solution. If the sand in the container is allowed to stand over night, the suspended material settles out, leaving a clear solution of dye. The dye unadsorbed then may be determined by color comparison. The standard color solution is made by dissolving 0.500 grams of crystal violet in 500 cubic centimeters of distilled water. Twenty-five cubic centimeters of clear dye solution are taken from the test by a pipette and run into one of a pair of carbon comparison tubes, such as are used in a steel analysis and shown in the accompanying illustration. The dye solution is diluted to 50 cubic centimeters and mixed thoroughly. Forty cubic centimeters or more of distilled water are added to the second comparison tube and the standard dye solution added from a burette until the color matches that of the test in question. Care must be taken that the final volume is the same in both tubes. If 2.5 cubic centimeters, 0.0025 grams, of the dye solution are required to match the color in the test, 0.0025 grams of dye remain unadsorbed in 25 cubic centimeters or 0.040 grams in 400 cubic centimeters. The figure obtained is subtracted from the amount of dye added to the test, multiplied by four, the result being the dye adsorbed per 100 grams of sand expressed in milligrams.

The presence of ammonium acetate in the test is helpful in that it tends to bring about rapidly the subsidence of the fine particles which otherwise would remain in suspension. It has no serious effect on crystal violet. The addition of ammonium hydrate acts as a partial deflocculator and thereby breaks up the agglomerations of clay or other bonding substances.

Only the highest grade of crystal violet should be used. Impure dye gives low figures and is unstable. Standard dye solution should be kept in the dark, and a fresh quantity should be prepared frequently.

The dye adsorption test cannot be relied upon for all grades of used sands. Impurities present in some heap sands, as for example, iron scale, organic binders, etc., seriously affect the adsorption results.

The final concentration of crystal violet should be not less than 0.024 grams, or more than 0.060 grams, in a 400 cubic centimeter volume. A



COLOR COMPARISON TUBE HOLDER WITH TUBES IN PLACE

greater excess of dye gives a high reading. After making a few tests it is a simple matter to judge the density of a clear dye solution, and it is essential that the proper concentration be obtained before the test settles overnight.

Request Rules Covering Cupola Operation

Question—We will appreciate your advice on a few points in connection with the operation of our cupola lined to 32 inches. The blast is supplied by a positive pressure blower delivering 13 cubic feet of air per revolution. We require extremely hot iron for our work and want to know particularly: (1) The proper height of water in the pressure gage; (2) tuyere area; (3) amount of iron melted per hour; (4) amount of coke required; (5) speed of blower.

Answer—Taking your questions in the order indicated: (1) A gage pressure of 10 ounces is satisfactory for a cupola lined to 32 inches. If you have the gage furnished with the cupola you will find the gradations marked in ounces. However, if for any reason you find it necessary to rig up a gage you may secure an approximately accurate reading by painting marks 1 inch apart on two pieces of 1-inch glass tube. The tubes are secured in an upright position about 3 inches apart. They are connected at the bottom by a piece of rubber tubing. The upper end of one is left open and the upper end of the other is connected to an iron tube extending to the wind box of the cupola. The tubes are filled with water to a zero mark about half way from the top to the bottom. A pressure of 1 ounce is equivalent to a 1-inch square column of water 1.73 inches high. Therefore on a 1-inch diameter tube the height is about 2 inches. From the foregoing it is apparent that with a pressure of 10 ounces the water will be driven 10 inches below the zero mark in one tube and 10 inches above it in the other.

(2) Eight tuyeres 8 x 4 inches, or approximately one-third of the area of the cupola taken horizontally at the melting zone is advisable.

(3) Where a cupola is operated properly it will melt 10 pounds of iron per hour per inch of area at the melting zone. The area of a 32-inch cupola is 2 x 32 x .7854= 804 inches. This multiplied by 10 gives 8040 pounds or about 4 tons per hour.

(4) The quality of the coke to a considerable extent determines the amount to be used. Usually satisfactory iron may be obtained by charging 500 pounds of coke on the bed and making the succeeding charges of 150 pounds of coke and 1500 pounds of iron.

(5) One ton of iron requires 30,000 cubic feet of air to melt it. Therefore, 4 tons require 120,000 cubic feet. If 120,000 cubic feet are consumed in one hour then 120,000 ÷ 60 = 2000, are consumed in 1 minute. You state that the blower delivers 13 cubic feet per revolution therefore 2000 ÷ 13, or, 155 is the number of revolutions per minute. At least 10 per cent should be added to this for friction, leaks, etc. A manufacturer recommends a speed of 255 revolutions per minute.

Avoid Dust Hazard

The standards of the New Jersey bureau of hygiene and sanitation say that dust and refuse produced by woodworking machinery in the pattern shop should be removed by a system built according to standard specifications and provided with a device for forcing steam into the pipes to extinguish any possible blaze.

Program for Milwaukee Nears Completion

Comprising over 50 papers on a wide range of subjects and holding features of vital interest to foundrymen, the tentative program for the Milwaukee convention of the American Foundrymen's association and the institute of metals division of the American Institute of Mining and Metallurgical Engineers has been announced. Sessions have been arranged for Monday afternoon and for Tuesday, Wednesday and Thursday, Oct. 13 to 16.

As in the past, separate simultaneous meetings are being arranged, grouped in such a manner that conflict will not be encountered. The general subjects of these sessions include, nonferrous castings, steel foundry problems, apprentice training, sand research, electric furnaces, aluminum and aluminum alloys, malleable cast iron and gray iron.

This year's annual exchange paper offered through the Institute of British Foundrymen will be "Modern Bell Founding," by Wesley Lambert and G. Hall, London, England. This will be presented at a joint session of the American Foundrymen's association and the Institute of Metals division.

Completing New Plant

The Washington Iron Works, Seattle, one of the largest manufacturers of logging engines and equipment in the country, is completing its large plant. The new plant consists of three main units, the foundry, the machine shop and the boiler shop, which now are occupied. An additional unit of offices soon is to be erected. The foundry, located on the eastern side of the plant, is 400 feet long and 126 feet wide and the chipping room, 66 x 216 feet is across one end forming an L.

The pig iron, scrap iron and steel used in the gray iron cupola and the electric furnace are stored in the yard adjacent to the railroad siding, and are taken directly to the furnaces. The foundry is arranged to keep the iron and steel castings separate until they are cleaned. The molten metal is handled with overhead cranes having a 45-foot span and a capacity of 15 tons. From the molding floor the castings are taken to the cleaning and chipping room where they are sand blasted and chipped, cleaned and annealed, with as little carrying back as possible. The foundry is light and well ventilated. The machine shop is 128 x 574 feet and divided into three bays the full length of the building.

Producing High Test Castings

Exacting Methods Employed in Producing Special Lines of Castings To Comply with Rigid Specifications—Care Exercised in the Mixtures Used, and Pouring Temperatures

IN MAKING high grade casting such as dies for punch-press work, cylinders, lathe beds, etc., where such castings are purchased on rigid chemical and physical specifications, it is essential that the highest grade of materials be used and the best foundry practice followed if satisfactory results are to be obtained.

In making suitable die block castings for example, the metallurgical problem involved is rather complex as the requirements apparently are contradictory. Die blocks to be considered satisfactory, must have toughness to resist shock and they must resist excessive wear which necessitates hardness of face. To obtain toughness and hardness in cast iron without brittleness is one of the problems involved in making these castings satisfactory.

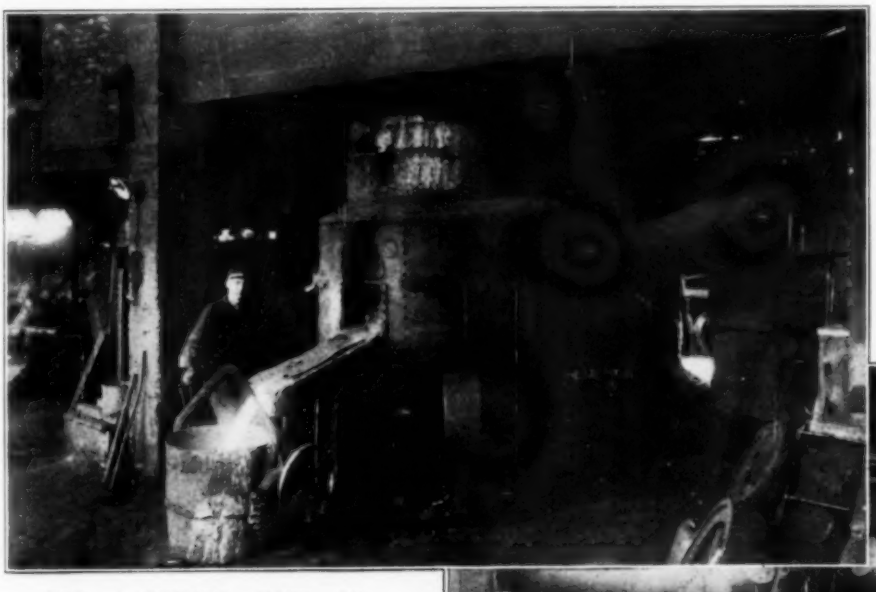
In producing castings to give high physical properties, the grain size is of the greatest importance, as the finer and more uniform the grain, the more satisfactory will be the castings, and more uniform the contraction with minimum internal strains. The grain size is controlled by the rate of cooling or solidifying the molten metal after entering the mold. The more rapid the *set*, the smaller the grain size. The more uniform the rate of cooling, the more evenly distributed the grain formation. The rate of cooling must not be so rapid as to produce surface chills which would interfere seriously with the machinability of the casting. The rate of cooling or solidification is controlled by the cupola mixture used, dimensions of the casting; the temperature of the metal at the time of pouring, and finally by whether a green sand, skin dried, or baked sand mold is used. From a chemical and metallurgical angle, it is essential to have a low total carbon with a sufficient silicon content to keep the combined carbon as low as possible. The chief object is to have the graphite plains as small as possible to give a maximum strength in the cast metal, with a minimum amount of combined carbon to avoid hardness and brittleness, especially in the thinner sections of the castings.

Cast iron dies, cylinders, cam wheels, lathe beds, and other special machine parts are a few of the diversified kinds of castings that are being made at the present time by the Wessling Bros. Foundry Co., Cincinnati. The equipment and personal of the foundry is such as to enable the company to handle a wide range of light, medium, and heavy work which may require intricate cores and special iron to meet rigid requirements.

Variety of Work Handled

The wide variety of work handled by the company necessitates bench, floor and pit molding. During the past year 75 per cent of the work has been floor molding, 15 per cent bench molding and 10 per cent pit work. The foundry is well equipped with modern molding machines to turn out large volume of work in a short time, and is supplied with cranes to handle the heavy work. The main bay is spanned by a 10-ton electric crane made by Pawling & Harnischfeger Co., Milwaukee, and a 5-ton electric crane made by the Reading Chain & Block Co., Reading Pa., together with a 4-ton traveling crane made in the Wessling foundry. This equipment facilitates the handling of the heavier castings and also the heavy ladles used in pouring the larger molds.

Great care is exercised in all the details of molding to obtain clean, flawless castings true to pattern. Fig. 2 shows the cope and drag parts of a mold for punch presses. The lower half of the pattern is bedded in the drag. The cheek then is placed in position and bars



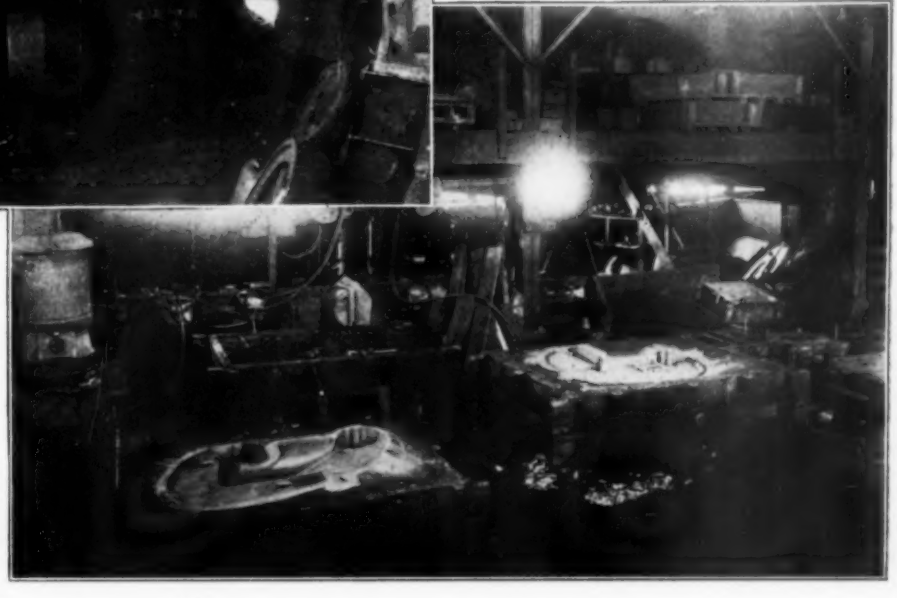


FIG. 1—CUPOLA USED IN MELTING STEEL MIXTURES. FIG. 2—COPE AND DRAG OF MOLD FOR PUNCH PRESS CASTINGS

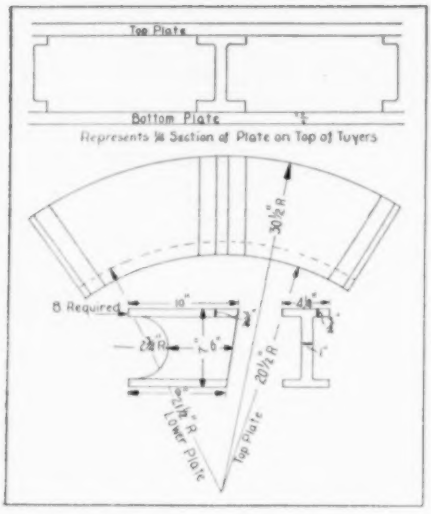


FIG. 3—SIZE AND LOCATION OF PLATES AND BEAMS USED IN MAKING SPECIAL TUYERES

are so placed as to support the center after which the cheek is rammed up and the upper parting is made. The cope is then rammed up and lifted off. The cheek is lifted and rolled over to draw the lower half of the pattern first. After drawing this half and finishing the mold it is blackened and turned back to its original position. The upper half of the pattern then is drawn and the mold is finished and wet blacked. A charcoal fire is started under the cheek and a gas flame is applied to the top of the cheek. The cope and drag are skinned dried with a gas flame. The mold is then closed and receives the molten iron.

Fig. 4 shows a tester wheel which is used in an automatic can-testing machine. The casting is six feet in diameter and weighs approximately 1700 pounds. The nature of the work for which this casting is intended necessitates a strong tough iron which will machine readily. The wheel must be perfectly balanced to function properly with the other parts which make up the complete, can-testing machine. The mixture used by Wessling Bros. for such a casting contains 50 per cent of low phosphorus pig iron, 30 per cent return scrap and 20 per cent of soft steel scrap. The casting gave the following chemical analysis: Silicon 1.75, sulphur 0.075, phosphorus 0.27, manganese 0.75 per cent. The tensile strength of a test bar poured from this mix gave 26,000 pounds per square inch.

The castings shown in Fig. 5 are characteristic of the class of work made in the Wessling Bros foundry. The die blocks shown in the foreground are for punch press work. These castings weigh approximately 400 pounds each. The cupola mixture used for such a class of work is made up of 50 per cent low phosphorus pig iron, 20 per cent return scrap and 30 per cent steel scrap. The chemical analysis of test bars poured from this mixture runs approximately as follows: Silicon 1.65, sulphur 0.095, phosphorus 0.22 and manganese 0.60 per cent. The tensile strength of the test bars gives an average of 35,000 pounds per square inch. The flywheels shown in Fig. 5 weigh approximately 500 pounds each and are poured from the 30 per cent steel mixture. The cam wheel shown at the end of the dies is poured from the 20 per cent steel mixture. The foundry superintendent designates the different mixtures as 10, 20, 30 and 40 per cent steel mix in preference to using the word semisteel.

In producing castings which give fine grain structure and high physical properties which necessitate the use of 30 to 40 per cent of steel scrap, it is essential that the mixing of the iron, melting, molding and pouring are carefully watched so as to avoid such ills as surface chills, sluggish iron, shrinkage, etc. It is more difficult to control such work than in making ordinary gray iron castings.

Describes Tuyere System

All raw material, such as pig iron, coke, sand, limestone, etc., is purchased under rigid specifications and submitted to chemical analysis when received. On the charging deck all material is handled by hand. The individual charges of pig iron, return and steel scrap are weighed and stacked carefully. The same care is exercised in charging the cupola with coke and iron so as to obtain uniform melting.

A cupola furnace made by the Whiting Corporation, Harvey, Ill., is used to meet the iron. The diameter of the

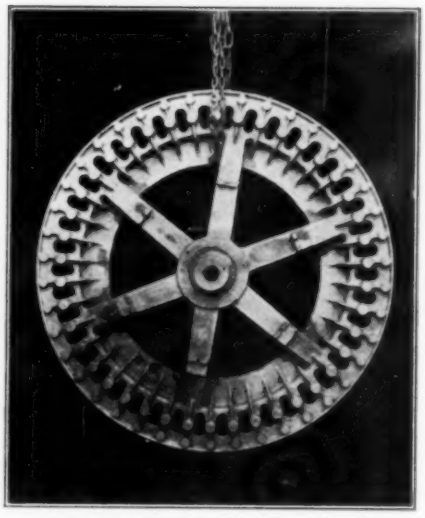


FIG. 4—AVERAGE RUN OF CASTINGS INCLUDES DIE BLOCKS, FLY WHEELS, CAM WHEEL, ETC

shell is 63 inches lined down to 45 inches. The tuyere system is an outstanding feature. It was designed and installed by Geo. W. Piehl, vice president and superintendent of the foundry. Fig. 3 shows a sectional view of the tuyere system. The upper and lower plates are supported by I-beams. The air is permitted to reach the fuel through a large area which softens its force and yet maintains its volume. It is claimed that such a system produces more rapid melting and hotter iron at the spout.

In charging the cupola 1400 pounds of coke are used on the bed. On this a 1000 pound charge of iron is placed, followed by 120 pounds of coke for each successive 1000 pounds of iron charged. When steel scrap ranging from 10 to 40 per cent is used in the cupola mixture,

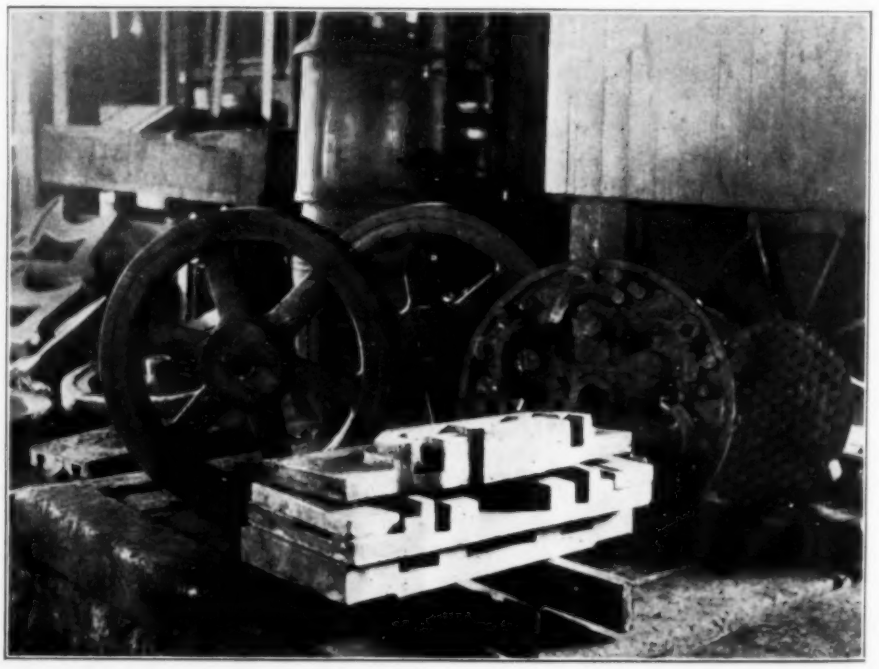


FIG. 5—WHEEL CASTING USED IN AUTOMATIC CAN TESTING MACHINE

the coke charge is raised from 120 pounds to 140 pounds in proportion to the amount of steel scrap used.

The air is supplied to the cupola furnace by a positive pressure blower made by the P. H. & F. M. Roots Co., Connersville, Ind. This operates at 320 revolutions per minute and gives an air pressure of approximately 13 ounces. The average melting capacity under such conditions is 7 to 8 tons per hour. The average melting ratio is 1 to 6. However, the melting ratio is not considered of any importance by the superintendent, as he believes that hot iron makes clean castings and to save on fuel at the expense of castings quality is poor business. The cupola used for melting the iron is shown in Fig. 1.

Melting Features Remain About the Same

Question—We are thinking of rearranging our foundry to enable us to pour continuously and would like to know what changes would be necessary in our two 44-inch cupolas. We make sanitary ware and would like to know particularly the proper height of the charging floor above the bed, the best proportion of iron and fuel charges and what blast pressure will insure the best results.

Answer—We should require further information before expressing a definite opinion. Your proposed tonnage will determine what changes, if any, are required in your two 44-inch cupolas. A 44-inch cupola should melt about 15,000 pounds of iron an hour, or, 30,000 pounds melted by the two cupolas. If your proposed molding capacity is sufficient to absorb 15 tons of iron an hour, the cupolas may be left as they are. If you have been accustomed to running the two cupolas for about two hours in the afternoon and during that time pouring 30 tons of iron and now wish to melt the same amount of iron, but spread it over an all-day period, the diameters of the cupolas must be decreased proportionally.

Several other factors exercise a direct influence on the problem. For example, it is more economical to operate one cupola than two and for that reason, either cupola should have sufficient capacity to melt all the iron required for a given day's work. According to this schedule No. 1 and No. 2 cupolas are operated on alternate days. Among the advantages of this system may be mentioned that one blowing unit, one charging gang, one charging floor, one cupola man and one crane will serve; whereas these various items, with the possible exception of the charging floor, would have to be doubled in the event that two cupolas are in blast at the same time.

Local conditions decide the height of the charging floor above the sand bed, but as a general rule it may be said that it should be at a height sufficient to place at least five charges in the cupola before the wind goes on. The proper fuel and iron charges can be determined by laying a single row of fire brick on edge around a circle chalked on the floor the same diameter as the inside of the cupola lining. Fill this enclosure level with coke and then weigh the coke. The amount will constitute the coke charge and the iron charge will weigh approximately 8 times that amount. A little experimenting will determine the amount to a nicety. You may be able to increase the proportion to 1 to 10 and again, you may find it necessary to decrease it to 1 to 7, depending on the quality of the coke and to some extent, the size and shape of your scrap.

The blast pressure is not an important factor and cannot be used as a foundation on which to base any calculations. It is the natural result of other conditions and not the cause. Volume of air forced into the cupola is the determining factor in a cupola's efficiency. A well regulated cupola will melt 10 pounds of iron per hour for every square inch of horizontal area at the melting zone, or, one ton for every 200 square inches. Thirty thousand cubic feet of air are required to melt 1 ton of iron and with these two factors in evidence it is no trouble to find the amount of air required for any given size cupola and then install a blower capable of delivering that amount.

Hard Iron Encountered in Small Sections

By George A. Drysdale

Question: We are troubled with hard iron in the smaller sections of castings that have to be machined and would like to know how to overcome this difficulty. We use a mixture of 40 per cent pig iron, 50 per cent soft scrap and 10 per cent return iron. The analysis of our pig iron is as follows: Silicon, 3.00; sulphur, 0.015; phosphorus, 0.80; manganese, 0.46 per cent. We use a local coke which runs over 1 per cent in sulphur and is of poor quality.

Answer: First refer to hard iron in the small sections of the castings. You have supplied the chemical analysis of the pig iron used in your iron mixture and the sulphur content of the coke used. However, the approximate analysis of the soft scrap used is not given and as this constitutes the largest proportion of the mix, we are forced to assume certain analyses and conditions. These assumptions are based on general foundry practice.

Your iron mixture at the present time runs approximately as follows:

	Silicon Per cent	Sulphur Per cent	Phosphorus Per cent	Manganese Per cent	Amount Used Per cent
Pig iron	3.00	0.015	0.80	0.46	40
Soft scrap (Foreign)	2.00	0.085	0.50	0.50	50
Return ..	2.25	0.090	0.50	0.45	10
Average .	2.42	0.057	0.62	0.47	100

The oxidation of silicon in cupola furnace iron is approximately 0.15 to 0.20 per cent, and in the air furnace 0.25 to 0.35 per cent. If your iron is melted in the cupola furnace, the theoretical amount of silicon minus the oxidation in melting should be 2.22 per cent.

You have not given us the maximum and the minimum thickness of the castings which are causing you trouble, or the condition of the sand at the time of pouring the mold, whether it is green sand, skin dried or baked, which materially affects the condition of the molten metal on pouring. We assume your castings range from ¼ to 1 inch in thickness. To overcome the hardness in the thinner sections, raise the silicon content in the iron mixture by using more pig iron, say 10 per cent, increase and reduce the amount of *soft scrap*, namely 10 per cent. In doing this, care must be exercised that the larger sections of the castings do not become too open grained or spongy. If the thinner sections show only slight surface chill, skin dry the molds.

The poor grade of coke which is used for melting purposes will necessitate using larger quantities than otherwise, with a lowering of your melting ratio and corresponding increase in sulphur. Molten iron having a strong affinity for sulphur, it is possible that your cast iron runs high in this metalloid which hardens the metal materially and tends to produce surface chills.

Issue 1921 Statistics on Nonferrous Metals

Figures for 1921 for the production of copper, brass, bronze and other nonferrous metals and alloys in bars and ingots have just been made available through the census department. A total of 48,666,535 pounds representing a value of $6,184,566 were produced. In 1919 the total value was $30,490,628.

The Ternstedt Mfg. Co., Detroit, has taken over the Shepard Art Metal Co. of that city, manufacturer of automobile body hardware.

Explains Use of Deoxidizers

The Value of Deoxidizers in Nonferrous Metals and Alloys Depends Solely Upon the Ability of the Melter To Know When and How To Apply Them Properly

BY CHARLES VICKERS

TO DEOXIDIZE or deoxidate is to deprive of oxygen, or reduce from the state of an oxide. It is a word much used in the practice of brassfounding, although of quite recent application in such connection. The addition of so-called deoxidizers, to the metals used by the brassfounder add to the expense of producing castings, and they would find little use unless experience had emphasized their importance when properly used as aids in producing sound castings.

The subject of the oxidation of copper was dealt with in two former articles; the July 15 and August 1, 1923 issues of THE FOUNDRY. Therefore, it is not necessary to enter into detail regarding the manner in which copper, while melting, takes up oxygen. Each time copper is melted it adds to its oxygen content, in commercial furnacing no matter how carefully the work may be done. The oxygen unites with the copper to form an oxide and as there will be only a comparatively small amount of oxygen and lots of copper, the oxygen unites with as much copper as it possibly can, forming cuprous oxide, which contains two atoms of copper to each atom of oxygen. To deoxidize a bath of molten copper the problem is merely to take away from the copper its oxygen—a comparatively easy matter, as the addition of any of the metals commonly used for making alloys of red brass, gun metal, or yellow brass, results in the deoxidation of the copper, it means that instead of oxide of copper the alloy contains the oxide of the added metal, if more than one metal is added, the oxide remaining in the alloy will theoretically be that of the element possessing the strongest chemical properties. In attempting to deoxidize bronze, red brass or yellow brass, it is not the easily reduced cuprous oxide that has to be contended with, but the more difficultly reducible oxides of other metals, such as tin, zinc, lead, aluminum, etc.

Discuss Methods of Poling

In the furnace refining of copper after all the impurities have been removed by oxidation there is left in the copper a surplus of oxide which has to be largely eliminated before the copper can be ingoted for the market. This is done by the process known as *poling* which is carried out by forcing into the liquid metal poles of green hard wood which in the case of a large furnace may be young trees. Poling is a very delicate operation, if carried too far the entire charge of copper will require to be brought back to its former state of oxidation, and then be refined. In the case of copper, poling, which to the uninitiated appears such a simple operation has to be carried out by workmen especially skilled in such work. Since the introduction of noncrucible melting furnaces into the brass foundry, poling appears to have captured the imagination of many in charge of melting operations, with the result that it is quite common for heats of red brass or bronze such as 88-10-2 to be *poled* before the metal is teemed into the ladles for carrying off to the molds. This practice is open to severe criticism. The poling of a bath of oxidized copper by experienced men is one thing, while the poling of a bath of copper alloy, usually by men who have no definite knowledge of how to do it, or why it should be done is another, different thing. The inexperienced melter is just as liable to fill the metal with gases, thus producing porous castings, as he is to improve the metal by removal of oxides. The experienced copper refiner knows exactly what he is doing when he poles. He tests his bath of metal from time to time to determine the state of the operation, and when he arrives at the condition known as *tough pitch* the poling is completed and the copper is ready for casting. During the casting period the metal is constantly watched and adjustments made to keep it at the proper pitch for successfully pouring the different sized ingots.

Exercise Care in Poling

The brassfounder usually is ignorant of the state of his bath of metal. He imagines it is oxidized, but the contrary may be true. The metal may be filled with reducing gases, to which the poling operation adds more. Even if it is oxidized and contains oxides, it is doubtful whether it would be possible to determine when the poling had been carried sufficiently far. We have no evidence the poling would reduce the oxides of tin or zinc to metal when these metals are alloyed with copper.

When difficulties arise owing to the porosity of the castings in foundries where poling is practiced, it is a good plan to omit the poling for a week or so in order to determine whether this operation is not responsible, for the porosity. The origin of poling in the brassfoundry may be traced to the fact of its being resorted to by some makers of castings of high electrical conductivity who after melting the copper in noncrucible furnaces would pole it back to a condition of *tough pitch* in which state a comparatively small addition of some deoxidizer like silicon copper may be used and still be effective in eliminating porosity. At the same time the electrical conductivity of the copper would be only slightly impaired, whereas minus the poling operation; to remove porosity, an addition of sufficient silicon would be necessary to lower the conductivity of the copper nearly 50 per cent. This would mean that a considerably larger and heavier casting would be required to carry the same current as the one of higher conductivity.

Use Deoxidizers Carefully

Considerable publicity was given this method at one time but the fact the originators of the practice were working with copper and had the process perfectly worked out, was generally overlooked by those who enthusiastically applied it to brass and bronze, and it would be interesting to know how many tons of brass castings have been made porous, and so ruined by the application of this method. It is a mistake to assume that any one method of deoxidizing, or any one deoxidizer is applicable and equally good in the case of all metals and alloys.

It is a mistake to assume that if a small quantity of any given deoxidizer is good, that a large quantity will be better. In the case of poling, it is a very old method of deoxidizing copper, and for that metal the only method that appears satisfactory. In the case of brass and bronze, it is more likely to work harm and cause loss than to do good. It might be of some value in the case of dirty scrap metal as the ebullition might assist materially in bringing up to the surface, some of the entangled oxides. To determine this point for a certainty it would be necessary to make a scientific study of the entire opera-

tion. Instead of taking the time and trouble to practice the poling operation, better results would undoubtedly be obtained by the addition of phosphorus at the beginning of the heat. The addition to be made in the shape of the 15 per cent phosphor copper, of which about 2 ounces per hundred pounds of brass, or bronze would be ample. Aside from its value as a deoxidizer, phosphorus thins the metal, making it more fluid than it is without the addition. This is a valuable property because it aids in the elimination of dissolved gases, as gas rises to the surface of a thin fluid more rapidly and perfectly than in the case of a thick or heavy fluid. Due to this property phosphorus is often effective in promoting sound castings when the metal has been gassed instead of oxidized; it comes nearer to being a universal deoxidizer than any element used for such purposes in nonferrous metals. Phosphorus is the most widely used deoxidizer of any, adapted to nonferrous castings and is a great favorite with those who seek to aid the brassfounder in his efforts to make castings free of porosity and dross. By selling him alloys which may consist essentially of copper with a small amount of phosphorus and possibly a little tin, and which are vaguely supposed to be perfect *cures* for what are termed *foundry ills* or *metal ills* whatever these terms may mean.

Oxides Are Nonmetallic

Oxides are nonmetallic substances and as such are undesirable constitutents of metals used for castings. The oxides of all the common metals such as are used in brassfoundries are solids. As such it is difficult to understand how they can cause porosity in the resulting castings, unless they evolve gases as the metal containing them solidifies. This, is doubtful, therefore, it appears possible that the subject of oxidation has been unduly stressed as far as brass foundry operations are concerned. This would result in efforts to deoxidize alloys that were deoxidized too much. If oxidation of the metal had been resorted to instead of deoxidation, the castings would have been sound, instead of being filled with blow holes. In most cases it can be assumed that efforts to remove causes of porosity are being directed the wrong way. When it is found that deoxidizers like phosphorus fail to correct the difficulty, and if the alloy is a leaded one, the addition of a charge of litharge, which is lead oxide instead of phosphorus will be likely to eliminate the porosity.

Not all metal that shows *oxidized* fractures is oxidized, as the *copper colored spots* may owe their reddish coloring to the absence of eutectic between the crystals, which absence may be due to its draining away to lower portions of the casting, or to the presence of a gas which drives away the eutectic from the affected part of the casting. The eutectic that settles around the crystals has a different color from the latter and where the two are blended the color of the fractured surface is grayish, whereas the crystals alone may be yellowish or reddish. If one part of the fracture is a normal blend of the two constituents of the alloy, and another portion consists entirely of the crystalline portion, the fracture lacks homogeneity and something is radically wrong with the alloy. It is possible the alloy is not properly proportioned. The various constituents may be unbalanced in their relation to one another. Thus when tin is high and by high is meant it may be within the upper limits in the range of useful alloys which contain from one to twenty per cent tin. The half of this being tin we will consider that below this figure is low, and above it, is high, thus giving low bronze and high bronze to correspond with high brass and low brass, which is so well known.

It is easy to unbalance alloys having a high tin content; a small proportion of any foreign element may cause the alloy to be out of balance. In this article the meaning of being thrown out of balance, will be taken as a measure of the fractured surfaces of the alloy. When the fracture shows a mixed alloy; yellow brass and bronze scrambled as it were, or copper, yellow brass and bronze all mixed, or even simply copper-colored spots, it will be termed *out of balance*. Opposed to this when the fracture is uniform the alloy will be considered balanced.

Balanced and Unbalanced Alloys

It is surprising how many alloys will have a balanced structure when they contain simply the esential constituents, and no *deoxidizer*, and how they will become unbalanced simply by the addition of some *deoxidizer*. It makes no difference what the deoxidizer may be, all of them have the same results in the case of certain alloys Phosphorus, manganese, calcium chromium, nickel, arsenic, zinc, aluminum, magnesium, iron and combinations of these elements, each and all will throw alloys out of balance when used indiscreetly To specialize therefore, in the manufacture of alloys to be used as deoxidizers and scavengers of nonferrous metals demands a knowledge of the art of putting together such alloys far removed from the superficial, and which cannot be obtained except as the result of a lifetime study of the subject, backed by many years of foundry experience and experimentation with alloys which will be used.

As far as *balance* is concerned, red brasses are exceedingly touchy, and all additions of so-called deoxidizers have to be kept very low, and in many cases they should not be used at all. A casting made of an alloy that is not homogeneous cannot be expected to hold gas or resist water pressures. It is a matter of great importance that the manufacturer of brass goods that are subjected to pressures, should know whether or not, his alloys are balanced alloys otherwise there will be endless trouble and losses due to leakers, against which deoxidizers of every kind are powerless; in fact they usually aggravate the case.

As a general rule it may be said that brassfounders are prone to take too much for granted; they are very apt to assume the alloys *they* make are satisfactory. They go blithely on their way mixing together all sorts of junk. Running a smelting plant and a brassfoundry together—and shutting their eyes to the size of the scrap piles which results from their efforts to carry on together two separate and highly specialized businesses. Finally they are brought up with a round turn by some costly happening which even they, with all their imaginary knowledge of the two businesses are unable to comprehend.

However, the cold-blooded business man, who never for a moment permits himself to be deluded into the belief that he is the possessor of special skill or rare intuition, which enables him to make good sound castings out of material that others are unable to use before it is passed through the refiners hands. Such a man rarely uses miscellaneous scrap metal, but taking the advice of his chemist and metallurgist, confines himself to virgin metals, and to ingoted alloys from reputable smelters. This practice taken in conjunction with a careful avoidance of all price cutting competitions enables him to make a little money out of a business, which numerous others have found to be a sink hole for savings.

Describe Test Bars Used

Anyone can keep a check on the alloys that are used to determine if they are homogeneous, and for all pressure castings such precautions can be highly recommended. It is simply to cast with each new heat a fracture test bar, break it and examine the fracture; Such a procedure to be carried out after a new deoxidizer has been used; not only to determine whether it is suited to that special alloy, but to adjust the proportions. The test bar is not important as to cross sections. A good size bar is 1⅜ inches square, with a sixteenth inch draft on either side to favor the

molder, this would make it 1¼ inches across the drag side. It should be about six inches in length, and it is best to cast it with a gate on one end and a riser on the other. Elevate the pouring end of the flask two inches and put the sprue on a runner extending down to the lower end of the bar as it rests in the mold on the floor. On the top end of the bar put a 2-inch diameter riser gated heavily into the end of the bar. In pouring such a mold the metal will run to the bottom of the mold and rise gradually up-hill filling the casting and lastly the riser. Long usage has shown this to be as good a way of molding as any, and that the bar will show conclusively whether, or not the alloy is homogeneous.

As an illustration of what the addition of too much deoxidizer will do in the way of unbalancing an alloy the following tests are suggested. Make an alloy to the following proportions; copper 83 per cent; zinc 11 per cent; lead 4 per cent, and tin 2 per cent. This alloy is a well known and so-called red brass, although the lead is too low in proportion to the zinc to produce an alloy having a reddish or gun metal color when finished by machining. The alloy has a yellowish cast, and is much used in making plumbers' supplies. Make a fracture test bar of this alloy using no deoxidizer, or *flux* except a covering of charcoal over the metal. When the test bar is cold, and it is always best to permit it to cool normally without water hastening, saw a nick about 3/16 inch deep across one side, usually the cope side of the bar, then break it with a sledge, place the bar on two solid supports, one at either end, with the nicked side downwards. It will be found the fracture is perfectly homogeneous; and is all of one color. Such an alloy will be found by test to be satisfactory for pressure castings such as plumbers brass work. It might be well to state here that when low pressure work is alluded to, it is such as red brass is usually subjected to and not high pressure such as demand special alloys. These will be taken up in later articles.

The red brass fracture being homogenous in structure is perfectly satisfactory for ordinary water and gas pressures and the alloy given has been satisfactorily used for such purposes for many years. Suppose another heat of this alloy is made and it is deoxidized with phosphorus, adding as small an amount as represented by 0.25 per cent of phosphor copper containing 15 per cent phosphorus which is equivalent to 0.0375 per cent phosphorus. Another fracture test bar is cast, cooled, nicked, broken, and the fracture examined. It will be found the fracture is mixed as though red and yellow brass had been scrambled together. This change in fracture must have been caused by the deoxidizer. The metals forming the alloy were the same proportion as in the first experiment. The only addition being phosphorus. The alloy is properly proportioned, otherwise the first bar would have been unbalanced, and shown by a mixed fracture. Evidently the second alloy could not be relied upon to resist even the slight pressures red brasses are exposed to. It is an example of over-deoxidization, and such a condition brass founders have to guard against. The same thing is found in bronzes, for instance the alloy known as *Composition H*, the normal composition of which is around, copper 83 per cent; tin 13.5 per cent; zinc 3.5 per cent. In one experiment an addition was made to the above composition of 0.0375 per cent phosphorus, and the result was an unbalanced fracture which appeared to consist of two alloys distributed throughout the alloy; one was yellow in color and the other was gray. In a second test an addition of 0.020 per cent metallic arsenic was made. This was not as bad as the first test with the phosphorus, no doubt due to the fact of a smaller quantity of arsenic being used. In this last case the fracture consisted of yellow specks on a gray background. It is not at all uncommon to find these same yellow specks in the fracture of manganese bronze, they are known as lemon-colored spot, and metal containing them will meet extremely low specifications. Such defects are never found in manganese bronze, properly proportioned and when the various constituents have been knit together by heat, which is essential in the case of alloys consisting of two main constituents of widely differing melting points.

Deoxidizers and Alloying Elements

It must be remembered that the so-called deoxidizers can be used in two different ways, viz;—as deoxidizers and as alloying elements. In the one case a comparatively small amount is used, and theoretically the quantity should be gaged by the amount of oxide in the alloy to be removed,. Practically this is impossible in a commercial way, as there is always some excess added, and it is this excess that disturbs fractures and causes other troubles. When the deoxidizing element is used as an alloy it ceases to act as a deoxidizer. In every case it requires to be deoxidized itself to permit sound castings to be obtained. Silicon is a wonderful deoxidizer for copper, and for other alloys, but when it is used as an alloy to make a silicon bronze, then there is trouble. The silicon has to be deoxidized to permit sound castings to be obtained. And this rule holds good with all silicon alloys, those of copper and those of iron.

A deoxidizer is not always a deoxidizer. It all depends on the amount used, small proportions promotes solidity, when used in quantity it becomes a part of the alloy, and the deoxidizer has itself to be deoxidized. Phosphorus may be considered an exception to this rule. High phosphorus alloys make porous castings quite easily, which trouble can be frequently cured by a little manganese. The reverse is also true, in the case of high manganese alloys containing two or three per cent manganese. The metal rolls, it does not run. The use of phosphorus or aluminum will correct this difficulty by liquidating the alloy. This latter element is a wonderful deoxidizer. It is also a cleanser. Aluminum must not be used in excess; its function is to do its work and disappear. A new school of thought in regard to nonferrous alloys imagine that by adding the aluminum mixed with charcoal, there will be none left in the finished alloy, which causes us to arise and remark: "How wonderful is imagination." The trouble with aluminum is that heretofore it has never been used properly, either in ferrous or nonferrous metals. It has been simply added, and the residue has been left as alloy. What aluminum might do in the case of ferrous alloys such as steels may be determined by experiment, but in the case of nonferrous metals it has been determined that the more contaminated with iron and oxidation the chips and scrap may be, aluminum may be used to clean such scrap and make it equal to virgin metals, provided a sufficient amount of it is used, and the residue is removed after its work is done.

The Henry A. Poppert & Son Co., manufacturer of patterns in Milwaukee, and now conducting a large brass and aluminum foundry, machine shop and die casting plant, has purchased the buildings erected for the use of the former Bull Dog Tractor Co., Fond du Lac, Wis., and will move its manufacturing departments to the new location in September. The concern has built up a large business in steam pressure cookers, of which 25 are being made daily, and intends to increase the output to 125 a day in the new plant. The Poppert company also makes castings and finished parts for automobile plants and many other industries.

R. L. Johnstone, has been appointed representative in St. Louis for the Dings Magnetic Separator Co., Milwaukee.

How and Why in Brass Founding

By Charles Vickers

Molding Bronze Tablet

We are to make a table 15 by 21 inches in size and will appreciate advice in regard to the formula to use. The tablet will be exposed to the weather and we are figuring to cast it with the letters upwards, using a facing composed of half Windsor Locks sand and half Albany No. 00. The mold will be skin dried, and we desire your criticism of this method of molding.

An alloy used for statuary and good also for tablets is as follows:

ALLOY FOR STATUARY

	Per cent
Copper	89.50
Tin	5.00
Zinc	5.00
Lead	0.50

Some tablets put up at Saulte Ste. Marie are made of an alloy of the following alloy:

ALLOY FOR STATUARY

	Per cent
Copper	90.00
Zinc	7.50
Tin	2.50

Either of these mixtures may be used. A good method of molding is to cope the letters as the cope may be printed back and a smooth casting thus secured. If the pattern has to be lifted with the cope and the letters drawn, it would be best to mold the letters in the drag, as printing back would not be advisable in the case of deep lettering. Before skin drying, the mold should be sprayed carefully with molasses water, otherwise, the letters may wash. Many molders simply use mixed sands minus binders, but if the mold is going to be only face dried, common sense suggests the addition of binders.

Porosity of Castings in Aluminum Alloys

We have been finding trouble in getting solid castings of an aluminum alloy containing 70 per cent aluminum, 27 per cent zinc, and 3 per cent copper. We are sending you a casting to show just where the bad spot occurs, this area being marked. Can you assist us in remedying the difficulty?

As the porous spot is the only part of the casting connected to a comparatively heavy boss it looks as though shrinkage was the cause of the porosity and this may be remedied by taking off a heavy riser from the most conveniently gated part of the boss. This riser should be made higher than the usual cope by putting a sand head over it, through which the riser is continued 6 inches higher than the top of the cope.

We note that the joint leaves a deep seam in the casting. This is caused by too much water on the joint before the pattern is drawn. This is unnecessary and should be discontinued but it indicates the molder is not sparing of his swab. If he swabs the part, which comes porous as liberally as he does the joint, this part will be made defective whether a riser is put on the hub, or not. The casting appears to have been poured hotter than necessary, since there is a faint crack at the junction of the hub with the body of the casting. The metal itself appears to be satisfactory. Therefore, the porous spots may be eliminated by feeding to overcome shrinkage as outlined. Since chills would be difficult to apply to this spot, the moderate use of water on the molds, and by pouring at as low a temperature as possible and perfectly run the castings. If the alloy shows a faint red it will be as hot as is advisable to run the castings.

Aluminum Solder of Low Melting Point

We desire to obtain a formula for an aluminum solder. We also would like to learn if there is any material that can be substituted for plaster of Paris that will be less brittle.

The following solder for aluminum has been suggested by the United States bureau of standards:

ALUMINUM SOLDER

	Per cent
Tin	84.00
Zinc	9.00
Aluminum	5.00
Phosphor tin	2.00

The melting range is from 200 to 260 degrees Cent., tensile strength 11,200 pounds per square inch, elongation 8 per cent in 2 inches, reduction of area 41 per cent.

A mixture of two parts aggregate and one part portland cement mixed with a 10 per cent solution of waterglass in water would make a stronger mass than plaster of Paris, but it would have to be used immediately as it sets rapidly.

Scrap Is Troublesome

We are casting compression stops and experience difficulty getting them water tight. They leak at the head and filter water even under slight pressure. For copper we use wire from which the insulation has been burned and which has been scrapped for several years, and we melt with coke. We should be pleased to have you tell us how to make an alloy that will not leak.

The scrap copper wire is without doubt badly oxidized, and when it is melted this oxide remains suspended, then is partially changed to tin and zinc oxides on the addition of these metals; all of these oxides remain in the molten metal to a considerable extent and as a consequence the castings are partly metal and partly dross, and it is the latter that is not water tight. The copper oxide must be reduced to copper before the tin and the zinc is added. As copper oxides are reduced to copper by calcium carbide at a red heat, this substance may be used to purify the copper. It should be reduced to a powder and be placed in the bottom of the crucible with the copper which is then melted, the charcoal being on top. When just molten the contents of the crucible should be thoroughly stirred to bring up the carbide, then a little common salt added and the metal heated strongly for 5 minutes, after which period it may be alloyed. Use from one-fourth of one per cent carbide upwards, the exact amount being determined by experiment. For example, should there be a large percentage of leakers after the first treatment with carbide, increase the amount the next time, and do this until the correct amount is discovered. The first skimmings of carbide should be tested by putting into water, then if much carbide is shown to be present, the skimmings may be used over again, with the addition of a small amount of new material. As the skimmings will always contain some carbide it is advisable to throw them into water after they are done with every night, by this means danger of fire is avoided. Work to the following alloy:

PRESSURE ALLOY

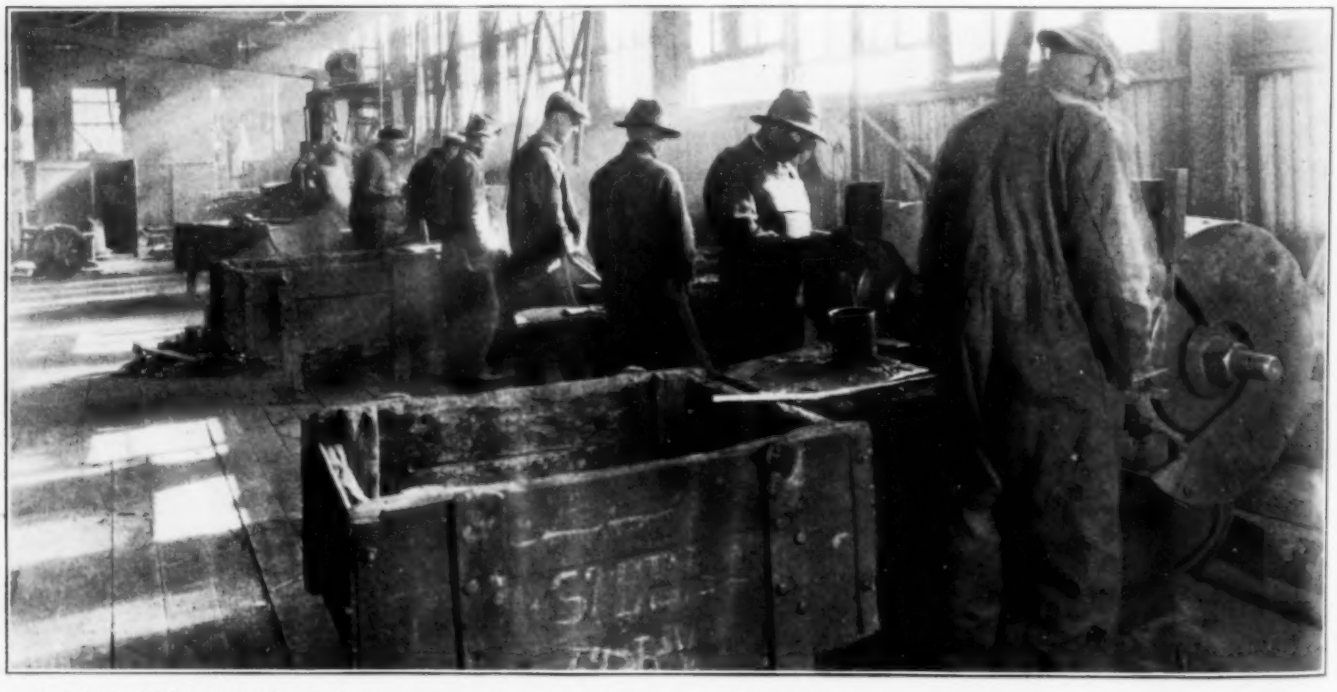
	Per cent
Copper	84
Zinc	10
Tin	2
Lead	4

Large castings are ground under swing-frame machines fitted with safety-flange type wheels

Cleaning Steel Castings Economically

THE Ohio Steel Foundry Co., Springfield, O., produces electric steel castings exclusively, the metal being refined in a three-ton Moore furnace. The average daily output is 24 tons of castings ranging in size from a few pounds to two tons. The company's cleaning room is housed in a building, 150 x 300 feet, the equipment being so arranged that the work progresses without backtracking. The cleaning room operations consist of sand-blasting, tumbling, removing gates and risers, grinding, chipping, polishing and inspecting.

The castings are sandblasted or rattled according to their size. Large castings are sandblasted in a rotary table machine while the smaller ones are tumbled. Gates on small castings are cut off with a sprue cutter, others are necked and knocked off and some are burned off with oxyacetylene torches. In some cases, when handling certain alloy steels it is practicable to cut off the gates and risers with aluminum oxide elastic-bond wheels, 50 grit K grade. The wheels are 8 inches in diameter and 1.8 inches thick. The size of the castings determines the grinding process. Large castings must be ground under swing-frame machines while smaller ones are handled on floor grinders. The company operates six swing-frame machines which were constructed at its Lima, Ohio, plant. These machines accommodate wheels 18 inches in diameter, 2½ inch face,



MEDIUM SIZE CASTINGS ARE SNAGGED ON FLOOR GRINDERS EQUIPPED WITH SUBSTANTIAL SAFETY HOODS

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Cut to this point

TYPICAL ANALYSES OF MISCELLANEOUS COMMODITIES USED IN FOUNDRY PRACTICE

By J. M. Quinn

Commodity	Name Symbol	Titanium Oxide TiO_2	Silica SiO_2	Ferrous Oxide FeO	Ferric Oxide Fe_2O_3	Alumina Al_2O_3	Calcium Oxide CaO	Manganous Oxide MgO	Sulphur S	Ignition Loss	Water H_2O	Alkali	Volatile Matter	Source of Data	
REFRACTORIES															**REFRACTORIES**
Brick—Alundum—Clay Bonded		2.59	11.12	.....	0.73	85.52	0.06	0.06	.....	.....	.....	0.11	.....	Norton Co., Worcester	1922
Suprafrax		3.63	20.44	.....	2.09	73.10	0.27	0.13	.....	.....	.....	0.79	.....	Laclede-Christy Clay Products Co., St. Louis	1922
60% Alumina		3.00	33.20	.....	2.00	60.00	.....	0.30	.....	.....	.....	1.50	.....	Harbison-Walker Refractories Co., Pittsburgh	1922
70% Alumina		3.50	23.30	.....	1.70	70.00	.....	0.30	.....	.....	.....	1.60	.....	Harbison-Walker Refractories Co., Pittsburgh	1922
Arcofrax		3.01	10.08	.....	1.50	84.52	0.11	0.22	.....	.....	.....	0.54	.....	American Refractories Co., Pittsburgh	1922
Durox				98 Plus % Alumina Mone-Silicate.						(Sillimanite)				The Vitrifrax Co., Los Angeles	1922
Diamel				99 Plus % Magnesium Aluminate.						(Spinel)				The Vitrifrax Co., Los Angeles	1922
Brick—Bauxite		.....	38.40	.....	2.95	56.75	Trace	1.10	...	.....	.....	0.85	.....	Bureau of Mines, Columbus	1922
		Silicon Carbide SiC													
Brick—Carbofrax A—Bonded		Above 90.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	The Carborundum Co., Perth Amboy	1922
Brick—Carbofrax C—Bonded		Above 94.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	The Carborundum Co., Perth Amboy	1922
Brick—Refrax—Re-Crystallized		98.00 99.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	The Carborundum Co., Perth Amboy	1922
		Chromic Oxide Cr_2O_3													
Brick—Chrome		40.00	4.00	.....	17.00	23.00	.....	16.00	.....	.....	.....	.....	.....	Harbison-Walker Refractories Co., Pittsburgh	1921
Brick—California Chromite		52.12	12.12	.....	15.24	2.18	.....	12.29	.....	.....	.....	.....	.....	Bureau of Mines, Columbus	1922
Brick—Grecian Chromite—Self-bound		4.74	26.01	2.30	.....	30.17	13.26	17.27	.....	.....	.....	.....	.....	Bureau of Mines, Columbus	1922
Brick—Clay—1st Quality		.....	52.20	.....	2.18	43.42	0.40	0.40	.....	.....	.....	1.47	.....	Bureau of Mines, Columbus	1922
Brick—Clay—2nd Quality		.....	66.20	.....	1.12	29.83	1.27	0.29	.....	.....	.....	1.24	.....	Bureau of Mines, Columbus	1922
Brick—Clay		1.30 3.50	45.21 81.36	.....	1.16 3.94	16.30 51.27	0.28 0.70	0.11 0.55	.....	.....	.....	0.38 2.05	.....	Refractories Mfg. Association, Mellon Institute, Pittsburgh	1922
Brick—Magnesite—Light Color		.....	3.70	.....	3.20	0.60	2.90	89.60	.....	.....	.....	.....	.....	Clyde Iron Works, Scotland	1915
Brick—Magnesite—Dark Color		.....	2.80	.....	9.88	1.20	3.20	82.92	.....	.....	.....	.....	.....	Clyde Iron Works, Scotland	1915
Brick Silica		.....	94.00	.....	2.06	1.67	1.50	0.25	.....	.....	.....	0.52	.....	Pickford, Holland	1915
Brick Silica—Steins Daisy		.....	94.92	.....	1.29	1.70	1.80	0.29	.....	.....	.....	.....	.....	Clyde Iron Works, Scotland	1915
Brick Silica		.....	93.45	.....	.....	3.20	1.90	0.15	.....	.....	.....	.....	0.10	Illinois Steel Co., Chicago	1909
Brick Silica		.....	95.60	.....	.....	0.70	2.30	0.10	.....	.....	.....	.....	0.20	Illinois Steel Co., Chicago	1909
Brick Silica		.....	95.70	.....	1.00	1.00	1.90	0.20	.....	.....	.....	0.10	.....	Harbison-Walker Refractory Co., Pittsburgh	1921
		Zirconium Oxide ZrO_2													
Brick—Zirkite—Grade No. 1		70.00 72.00	15.00 20.00	.....	2.50 3.00	.....	.....	.....	.....	.....	.....	.....	.....	Foote Mineral Co., Philadelphia	1920
Brick—Zirkite—Grade No. 2		80.00 85.00	10.00 15.00	.....	1.00 2.00	.....	.....	.....	.....	.....	.....	.....	.....	Foote Mineral Co., Philadelphia	1920

(*Continued on Data Sheet No.* 541)

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Note—This sheet may be cut along this line and one half folded over on the other to bind in 5 x 7 inch note book.

THE FOUNDRY DATA SHEET, SEPT. 1, 1924

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

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January 3, 1924

The Penton Publishing Co.
West Third & Lakeside Ave.
Cleveland, Ohio.

Attention: Mr. J. D. Pease

Gentlemen:

We have been very much interested in the letters from your advertisers, which have been appearing in each issue of THE FOUNDRY, telling you how highly they regard your paper and the benefits they have derived as regular advertisers. The experience of these companies is the same as our own, and we would feel we were unfair if we did not express to you our appreciation of the service and results we have obtained from our own advertising in THE FOUNDRY.

As you know, we have advertised with you for a number of years. In fact, yesterday I picked up one of our advertisements which appeared in your publication about six years ago.

Checking back the results we have had from our full page advertisements it is gratifying to be able to say to you that our experience has been that in no other way can we invest our money in advertising and get the results we do from THE FOUNDRY. The rapid growth of our business and the nation-wide distribution of our Famous Cornell Fluxes and Parting largely is attributable to our continuous advertising in THE FOUNDRY.

It is a privilege and pleasure for us to recommend advertising in THE FOUNDRY.

Very truly yours,

THE CLEVELAND FLUX COMPANY

Clifford B. Cornell

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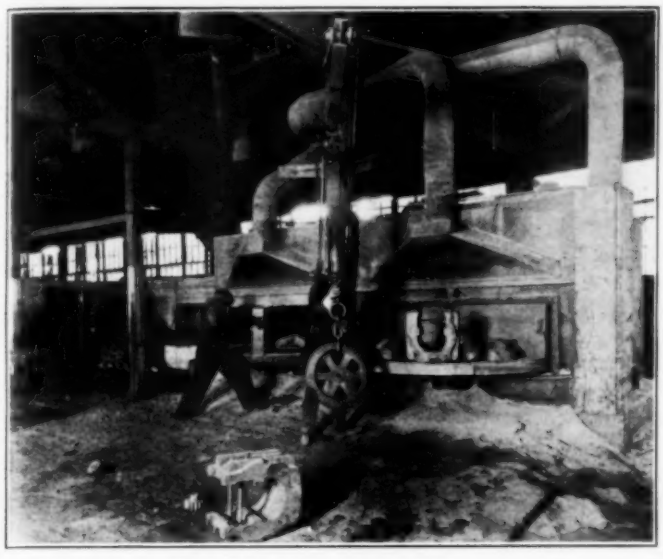


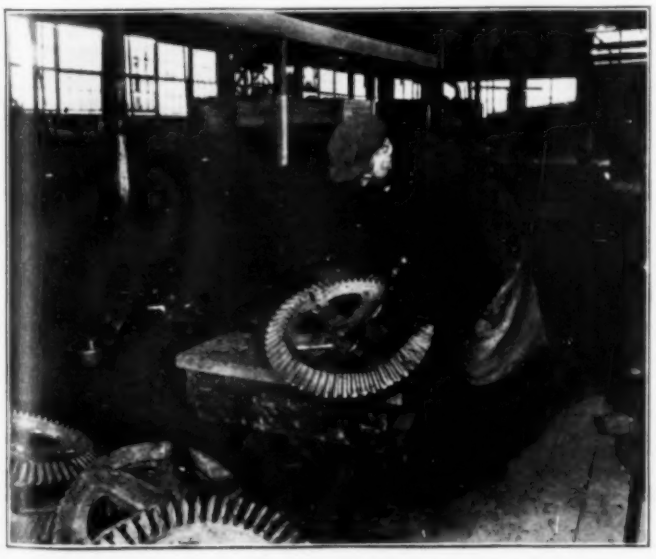
CASTINGS ARE SANDBLASTED IN LARGE ROTARY-TABLE INSTALLATIONS

GATES AND RISERS ARE REMOVED WITH AN OXY-ACETYLENE TORCH

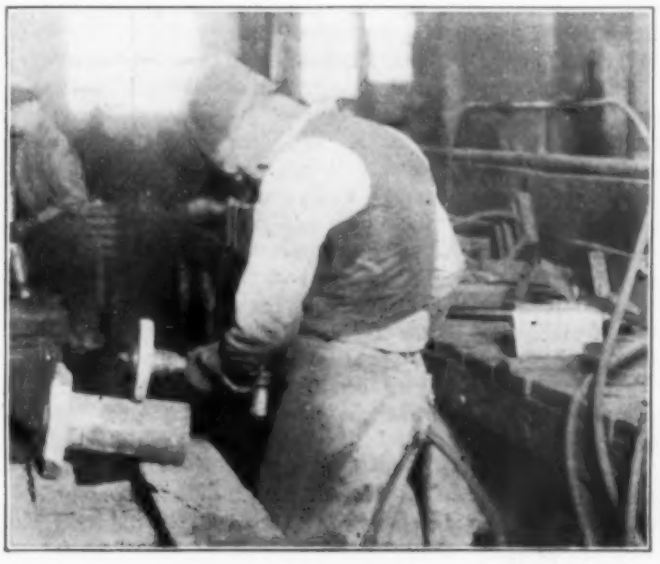
safety flange shape. They are aluminum oxide, 12 grit, G grade and 12 grit, O¼ grade. These wheels are operated at a peripheral travel of approximately 5500 feet per minute. The six floor grinders are arranged at one side of the cleaning room. They accommodate safety-flange shape wheels 24 inches in diameter. These wheels are the same grit and grade as used in the swing-frame machines. The method of operating the wheels to preserve a constant peripheral travel is to start them on one of the floor grinders. After they have been reduced in diameter an inch or so, they are transferred to a machine with a higher spindle speed. Thus, the wheels pass down the line of the floor grinders and when they have reached a diameter of 18 inches, they are used on the swing frame machines. All the grinding machines are equipped with adequate guards, the diameters of which are such that it is an impossibility to mount a wheel that is too great in diameter for the spindle speed of that machine. By this method economical wheel consumption is assured. The wheel stubs are broken up and are used for rubbing castings. In some instances the castings can be cleaned more economically with portable grinders. In this case pneumatic grinders equipped with aluminum oxide wheels, 8 inches in diameter and 1 inch face are used. These wheels are 24-26 grit, P grade. They are operated at a peripheral speed of 5000 feet per minute. All of the castings are annealed and after removal from the oven they are chipped with pneumatic hammers. Then the castings are rattled to polish them. This is performed in ordinary

Sources of Abrasive Equipment

Operation	Machine	Wheel
Cutting off risers	Chicago Pneumatic Tool Co.	Carborundum Co.
Swing frame grinding	Ohio Steel Castings Co.	Carborundum Co. and Safety Emery Wheel Co.
Floor grinding	Safety Emery Wheel Co.	Carborundum Co. and Safety Emery Wheel Co.
Portable grinding	Chicago Pneumatic Tool Co.	Safety Emery Wheel Co.



SECTIONS THAT CANNOT BE GROUND READILY ARE CHIPPED



MANY SMALL CASTINGS ARE GROUND WITH PORTABLE MACHINES

tumbling barrels, the polishing medium being lead bushings taken from old wheel stubs. This material imparts a satisfactory polish and according to the Ohio company is entirely satisfactory for this purpose. Wheel stubs are not used for polishing because it has been the experience at this plant that when wheel stubs are placed in the tumbling barrels the abrasive dust created by this method wears the exhaust system rapidly.

Skin Drying Molds Is an Old Practice

BY ROBERT E. MASTERS

IN AN article in THE FOUNDRY published some time ago, George Boys told of migrating from England to Australia about 30 years ago where he first learned the advantage of skin drying molds. On his return to England he put this method into practice, the results being highly acceptable to the foundry foreman and owners.

This practice may not have been known in that particular district, but it was known in England long before the time stated in the article mentioned. The writer saw it practiced in Fawcett & Preston's foundry, Liverpool, on marine work made under the direction of Thomas Lowe, foundry foreman. He also saw molds being skin dried at the Royal Arsenal Foundries, Woolwich, under John Ginno, who was in charge of foundry work there over 35 years ago.

Not wishing to rob Tubal Cain of his hard earned job, I will make the modest claim that skin drying work must have been practiced in American foundries for 100 years. I was indentured 58 years ago on Oct. 1, 1865 to serve a three years' apprenticeship in an old foundry over the East river in New York and skin drying was in practice at that time, no one seeming to consider it unusual or contrary to good foundry practice.

The Aetna Iron Works, the Morgan Iron Works and the Mott Iron Works were three famous plants in the early day when I started my apprenticeship. Before going further I would like to give a picture of that apprenticeship. The old foundry in which I first was employed made castings up to and including heavy marine work in green sand, dry sand and loam. Before the end of my apprenticeship I was able to do any job in the shop and my compensation was $3 a week for the first year, $4 for the second and $5 for the third and find myself. There was a stipulation in the agreement that any time lost was to be worked out at the end of the three-year period at the pay of the year in which the time was lost.

During all of this time I lived with an old couple down on Houston street and the Bowery. Here I was well cared for at $9 per month for "boardn, lodgin, washin and mendin." A reasonably good suit of clothes could be bought at that time for $6. No time was lost from work during the 3-year period, and after the expiration of the apprenticeship I worked for two months as a journeyman. I then went to work for the Pennsylvania railroad at Altoona, Pa., working on locomotive castings. I found that they were skin drying some work in their foundries at that time, which was over 55 years ago. This might indicate that this practice was widespread, even at that early date.

One of the best pieces of skin dried work that I recall, was made in the seventies. In 1874, only half a century ago, we made cast-iron, cotton screws 8 feet long, and having a 8-inch outside diameter, and a 4-inch core, with a thread 1-inch face and 1 inch deep running the whole length of the screw. The pattern was in halves, similar to a column pattern, each half being cut lengthwise in three sections. These sections were fitted together with brass, dove-tailed plates set at the same pitch as the thread. Each of the outside sections was held firmly to the center sections by big screws fitting into brass plates. After ramming, the cope was lifted in the same manner as when molding a column. The screws then were taken out and each section was drawn carefully. The mold was swabbed and dried with a fire built over each half on sheet iron plates. These molds were made daily and I do not remember of one being lost. In addition, we cast a big nut to fit the screws with shoulders for the power levers. The nuts were about 18 inches long and were cast on a dry sand core. The threads fitted so well that no machining was necessary.

Buy Steel Castings Plant

The Pawling & Harnischfeger Co., Milwaukee, which now is celebrating its fortieth year in the manufacture of crane and excavating machinery, recently has added a large steel foundry to its plant. This foundry formerly was operated by the Hercules Steel Casting Co., for commercial work, but now is devoted entirely to making steel castings required by the Pawling & Harnischfeger Co.

The foundry is served by a 10-ton electric, acid lined furnace. Two 10-ton overhead electric traveling cranes handle the ladles, heavy castings, etc. Cleaning, rattling, sand blasting, welding and annealing equipment is used to finish the castings. Baking ovens for dry sand molds, sand screens and a special conveying system for handling sand also are used in conjunction with the molding floor. The core room is equipped with two large oil fired furnaces and a small gas fired furnace. A 3-ton electric hoist handles the heavy cores and oven pans. The storage yard is equipped with a crane for handling heavy materials and has a magnet attached for handling pig, scrap, punchings, etc., from the separate bins to the furnace. A pattern shop, pattern storage and chemical and physical laboratories are run in conjunction with the plant.

Suitable Mixtures for Stove Plates

Question: Will you kindly give us the analysis of good stove-plate iron that will resist heat and still retain proper strength.

Answer: Stove-plate castings are made from iron of the following approximate analysis:

STOVE-PLATE MIXTURE

	Per cent
Silicon	2.25-2.75
Sulphur	under 0.08
Phosphorus	0.60-0.90
Manganese	0.50-0.80

In other words the castings are poured from what is known as an ordinary grade of gray iron. The lower silicon content is employed where the castings exceed ¼ inch in thickness and the higher content usually is found necessary where the castings are thin. The cupola charges are made up of pig iron and scrap in varying proportions depending on local conditions and the quality of the available scrap. Some foundrymen use no scrap except their own shop returns while others charge a sufficient amount of foreign scrap to bring the total scrap content of the charge up to 50 per cent. Rusty or burned scrap or scrap that has been melted frequently will produce iron of an inferior quality due to the oxides which are present.

Bill on How and Why Molds Are Stacked-V

BY PAT DWYER

SITTING on the veranda the other night in company with Bill, with our feet cocked at a genteel angle on the railing, I had almost fallen asleep when Bill for no apparent reason vouchsafed the opinion that some people never are satisfied. I asked him idly what difference that made to us one way or the other.

"Well," said he, "I'll tell you. If a good natured Providence sees fit to clothe their frames with a comfortable covering, they rebel bitterly and sigh for a shape like that of the living skeleton in a circus. On the other hand if the same Providence in its inscrutable wisdom decides to bestow on them just sufficient covering to hold their collection of bones in the shape of a human being, they rebel still more bitterly and read up on starchy food, carbyhydrates and vitamins.

"I know a lad who has the bug and unless the good Lord grants him a modicum of wisdom in the near future, he eventually will be a total wreck. When first captured in the jungles of Hartford, Conn.—note the Conn.—he had attained some fair measure of notoriety at the local county fairs. On two successive occasions he carried off the first prize in the Humpty-Dumpty class open to competitors from the original 13 states. He received honorable mention in the stall fed division and was runner-up in the open championship for the best all around specimen of a native son raised on blueberries and succotash. Official records show that his vertical measurement only exceeded his circumference at the equator by one scanty inch. If he had curbed his curiosity he probably would have continued to expand until he popped like a toy balloon. However, dear children, there is a destiny which shapes our ends—also our middles—and one day we find our hero prowling around in strange territory. Probably his sole reason in invading a department outside his own was to give the inhabitants a treat, a kind of a glorified look-me-over-kid, look me over!

"This visit marked the turning point. He had a momentary and fleeting glimpse of an expansive gaffer of much greater perimeter partially concealed behind a 4-foot column and fled in confusion. He realized his limitations, the utter futility of competing with a master hand, one who had taken full advantage of the opportunities presented in the dear old days when Milwaukee was a name and not a memory.

"There is no accounting for the vagaries of the human mind. Thwarted in his ambition in one direction this cuckoo decided to blossom out in another. You may have one guess. Correct. He decided to deflate. For the past month he has eaten nothing. Daily he places himself in the hands of an athletic trainer who conscientiously tries to pound the life out of him. Eventually—if he survives—he hopes to qualify as a bantam.

"Every day, clothed modestly in the modern equivalent for a fig leaf, he goes puffingly through a series of contortions closely paralleling those endured by the early Christian martyrs. The gymnasium attendant, who is built along the same general lines as the famous Bull of Basham, straps his victim on a hard, flat couch and then cheerfully attempts to pull each limb in turn out by the roots. Then he stands him upright on the floor and twists his head and neck alternately right and left through an arc of 180 degrees. This is repeated until the patient's eyes pop and his tongue hangs out helplessly. He runs on a treadmill until his feet smoke.

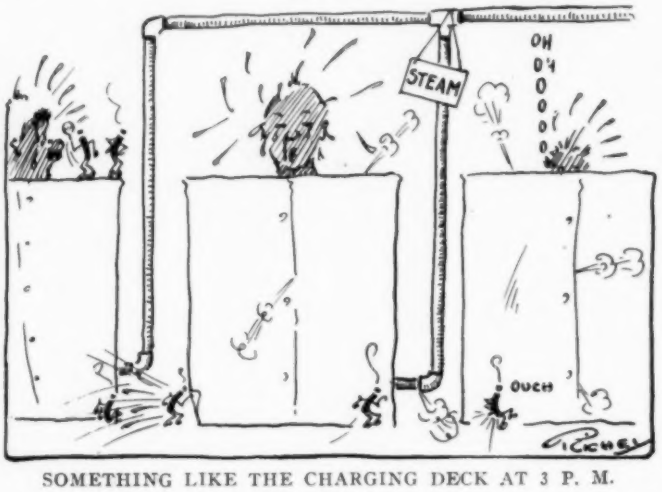
Then the trainer dons a pair of boxing gloves and pounds his groggy victim to a juicy pulp. What remains is given only a brief a breathing spell, when he is placed in a red hot cabinet where the last drop of moisture is sweated out of his poor quivering hide. In the last stage of the process he is suspended from a hook, where, as he slowly revolves, limp and spiritless, the trainer playfully sluices him with ice water from a fire hose at 40 pounds pressure.

The system may be all right, but wait. Just wait! Some day when his emaciated body is reduced to a fragment, when its weight is not sufficient to resist the force of the stream, it will be blown from the hook and washed through the waste pipe in the floor. You might say the foregoing has no bearing on the subject of stacked molds, but a little reflection should show you the analogy. Many men have many minds and therefore, it is not surprising to find that many methods have been adopted for stacking molds. In the fifth and last method to which I shall refer for stacking molds, the molds are not stacked in the usually accepted sense of the term. They are not placed one on

OH DEATH WHERE IS THY VICTORY

top of another to any desired height. I suppose if you wanted to set up an argument, you might claim they are not stacked and therefore the method should not be included in the list. In this method I have in mind and which I intend to touch upon briefly, if you have the necessary time and patience to pay any reasonable amount of attention, the molds are turned on edge and any number from 6 to 12 are clamped together in that position and poured through a single runner. This single runner receives the metal from the ladle and distributes it to the various mold cavities through suitable gates. Offhand, I cannot say that I recollect Mr. Webster's exact definition of the word *stack*. Neither have I any intention at the present moment of holding up traffic while you go searching through a copy of his well known best seller, for proof to show me that I am wrong, as usual. It seems to me that the word frequently is employed to describe objects other than those assemblies where one unit is piled on top of another. For example there is little in common between a hay stack and a steel smoke stack. The term *stacked arms* does not refer to an arrangement of weapons in which the rifles are piled like so much cord wood. If my memory serves me correctly, and I have no reason to doubt its accuracy, the writers of some of our best known thrillers, when they want to convey the impression that the hero is right up against a blank wall figuratively speaking, gravely inform the reader that the hero absolutely did not have the ghost of a *chance*—the cards were stacked against him.

"I sometimes wish these people would be a little more explicit. There are many kinds, classes, specimens and varieties of cards. In our highest circles of society, where every single act is governed by rules and regulations, by a long and arbitrary list of precedents hoary with age and tradition and where the unwary prospector speedily is strangled and smothered in the jungle of red tape, I have been given to understand that the presentation, or non-presentation of calling cards has resulted in the most disastrous consequences.



SOMETHING LIKE THE CHARGING DECK AT 3 P. M.

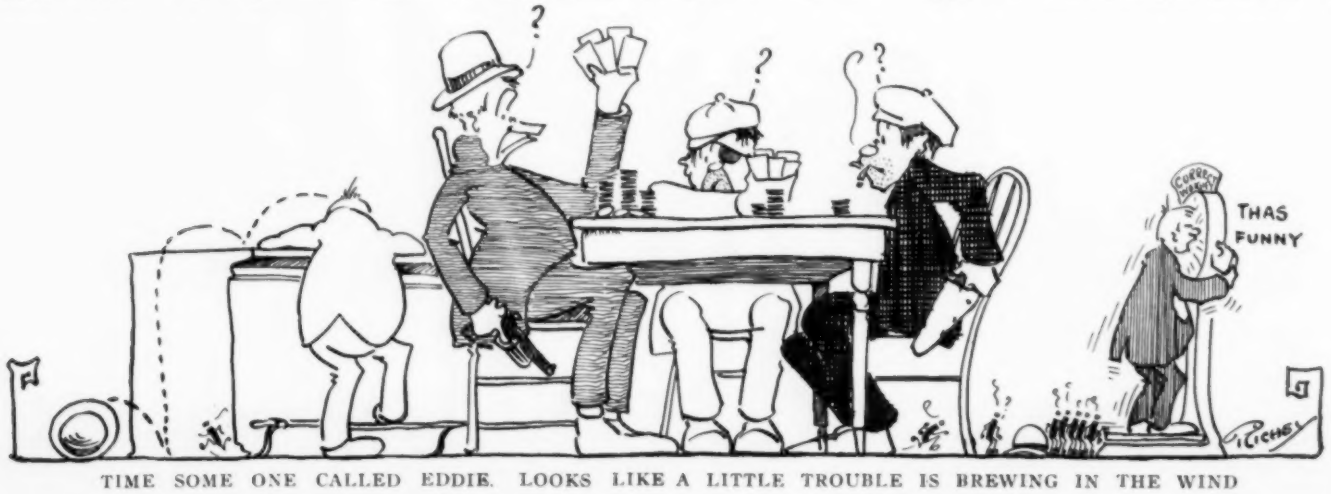
"When I read a statement to the effect that the cards have been stacked, were stacked or are about to be stacked, I am at a loss, momentarily to determine whether the author is referring to these neat little bits of pasteboard bearing the hero's name in a neat script (either engraved or a fair imitation) or, if perchance reference is intended to the familiar congress and bicycle varieties through whose aid, assistance and manipulation sundry and divers wickedly minded persons engage in games of chance."

" 'Games of Chance' is good," I said. "The expression is particularly felicituous coming from an old pirate who would sooner play cards than eat—or sleep. I was not present at the time and, therefore, have no direct proof to offer, but in my humble opinion you cut your first teeth on an old greasy deck. I am morally certain that when the time comes for you to cash in—I believe that is the proper technical term—or in other words when you finally are called upon to depart from this vale of tears your last dying request will be to have a deck of cards, asbestos cards, placed in your coffin. You won't need to play solitaire where you are going either.

"If I am not asking too much, will you kindly switch your mind from your favorite pastime and get back to where you started. I am not interested either in cards or card playing. If past experience is any guide on which to base an opinion I am convinced that in another minute, perhaps less, you will be telling me all about the time you had absolutely nothing in your hand. Then you drew a measly little pair and stood pat and buffaloed the gang into giving you a sweet little pot on three of a kind or some other equally silly technicality. Go ahead and talk about stacked molds either the vertical or horizontal stacks. Otherwise the chair will reluctantly consider a motion to adjourn."

"I'd hate to have a life-is-real, life-is-earnest mind," said Bill, "like some goofy birds I could mention. Why don't you let your mind ramble around once in a while and give it a rest. Concentration is all very well at times, but constant concentration produces a constipated mind and that is something that is of no benefit to any person if we except psycho-analysts and keepers of health resorts. However, since you are for the moment in a receptive mood I shall omit any further controversial references and resume the thread of our narrative.

"Stacking molds horizontally is not practiced extensively in the iron or brass foundries, but it is practiced quite frequently in steel foundries, particularly in shops engaged in the production of both heavy and light castings where the metal is poured from bottom-poured ladles. I



TIME SOME ONE CALLED EDDIE. LOOKS LIKE A LITTLE TROUBLE IS BREWING IN THE WIND

have touched on this point before and explained that the practice is due to the fact that the ladle must be emptied as quickly as possible to prevent the metal from cooling and also to prevent the nozzle from freezing. This object is accomplished by opening the nozzle a minimum number of times and by pouring as large a quantity of metal as possible each time the nozzle is opened. It is quite apparent that a considerable saving of time is effected by pouring a dozen castings at one time instead of pouring them one at a time.

"Molds designed to be poured in stacked horizontal formation usually are dried and may be made in flasks in the usual manner or made in cores. The method adopted is optional and usually it may be said that neither method presents any advantage over the other. Taking all the factors into consideration, perhaps the molds made in a corebox are produced and assembled more cheaply than those made in flasks, but where the initial cost of new sand is higher than usual, the differential may swing in favor of the molds made in flasks. Local conditions govern a foundryman in his choice of methods.

"In addition to the advantages derived from pouring several molds at one time, foundrymen engaged in certain lines of work have discovered that the best method to produce sound castings is to pour them on edge. Flanges designed for high pressure service come under this classification. Leaks and other causes of rejections found in castings poured horizontally in the usual manner and provided with one or more sink heads, disappear when the mold is poured on edge. The metal enters the mold near the bottom and fills a single sink head the full width of the flange on the periphery at the top. Incidentally this method also reduces the machining expense. The gate and riser may be removed with an acetylene torch and then the flange simply has to be faced on one side in the lathe or on the boring mill. Where one or more risers are placed on the back of the flange, the acetylene torch leaves a stump which has to be removed on the lathe, thus necessitating two set-ups and double time in the machining operation.

"A flange presents the most simple and familiar example of a casting made in the foregoing manner and a description of the methods involved may be regarded as typical of those practiced on other castings. It is flat on one side and therefore the flat bottom face of one mold serves as the cope face of the mold immediately preceding it. Other castings in which part of the mold impression has to be carried in the cope will involve a little more elaborate pattern equipment, but that is a minor detail. The basic principle of the method remains the same.

"The pattern is mounted on a board with a set gate attached extending into one corner of the flask and a block for a riser attached to that part of the rim that will be on top when the mold is assembled. A short runner stick of a size suitable for the row of castings and corresponding to the depth of the flask is placed upright on the outer end of the gate. The flask is filled with sand which is rammed either by hand or on practically any type of squeeze or jolt machine. The sand on the bottom is scraped smooth and flush with the face of the flask to form the cope surface on the succeeding mold and then the flask is removed and the mold cavity is coated with silica wash. The procedure is repeated as often as necessary after which the accumulated molds are placed in the oven and dried.

"The flask designed to form the center of the assembled group of molds is rammed as a blank with the exception that a long runner is formed close to one side, extending from what eventually will be the top to two short runners connecting with the corresponding runners on the two molds adjoining on either side. With this arrangement the metal has to travel only half the distance from the central runner, that it would have to travel if the stack was poured entirely from one end.

"Where the flask is small it may be necessary to provide an opening in one side for the riser, but usually it is possible to use flasks large enough to accommodate a blind riser, that is a riser with an inch or more of sand between the top of the riser and the flask wall. In fact a blind or covered riser wherever practical is to be preferred to one that is open. The metal in it will remain liquid for a longer period and perform its function of feeding the casting to better advantage.

After the molds are dried they are assembled on a level bed on the floor or on a long plate. The method adopted for clamping them together is optional and depends to some extent on the available rigging. Where the method is practised extensively, it is customary to provide special rigging. A plate is erected at each end of the stack and the entire assembly is bound tightly together by a pair of long bolts extending from one plate to the other.

Where the molds are made in cores, the method adopted is practically the same with the single exception that the sides of the corebox take the place of the flask. The pattern, gate and riser are attached to the bottom of the corebox. The box then is rammed full of core sand in the usual manner and rolled over on a core plate. The corebox is removed and the core is dried in the oven. The cores are assembled in the manner described for the flasks. The method is simple, rapid, within the capacity of unskilled labor and as before stated, usually is more economical than the flask method.

"I saw a machine recently, developed and patented by an ingenious foundryman for stacking shallow molds horizontally. The flask parts are 2 feet square and from 1 to 2 inches deep. It is readily apparent that a frame that size filled with sand and containing a great number of mold cavities cannot be lifted horizontally. The sand will fall out.

"The table of the machine is mounted on pivots. The mold is squeezed in the ordinary manner while in a horizontal position and the patterns are stripped out of the sand. Then the table and squeezing head with the flask between are swung to a vertical position. The table is lowered back to its original position, leaving the mold vertical. It is lifted away still in that position and placed on the floor on edge. Of course as a molder you are familiar with the fact that sand that inevitably will fall out of a flask held horizontally, will remain in position when supported vertically, in the same frame. The inventor uses the machine on a great variety of small shallow castings in his own shop, but so far as I know it has not yet been placed on the market. Probably other foundrymen have developed additional methods of stacking molds, but up to the present I have not learned of them and I have neither the desire nor the inclination to talk about things with which I am not familiar."

"For which," I said, "and for other small mercies, let us be duly thankful."

Melting Speed Depends on Volume of Air

Question: Our cupola is lined to a diameter of 48 inches and is provided with six 6 x 8-inch tuyeres located 18 inches above the sand bed. Provision is made for a slag hole 3 inches below the tuyere line, but we do not make up the slag hole and do not slag the furnace during the heat. The coke bed extends 42 inches above the sand bed. Air is delivered through a 16-inch pipe from a 19-foot Piqua blower. We charge from 2500 to 3000 pounds of iron on each charge and melt 24,000 pounds daily in two hours. Our melting ratio is 6 pounds of iron to 1 pound of coke and we employ oyster shells as a flux. The cupola practically is choked by the time we are through and involves a great deal of

work in getting it ready the following morning. We shall appreciate your suggestion on how to secure better operating conditions and a clean drop.

Answer: You have omitted one of the most important factors that would have assisted us in forming an opinion on the probable cause of your cupola melting so slowly. You have not indicated either the pressure or volume of the blast. The pressure is not of particular importance, but the volume has a direct bearing on the melting speed. When you refer to a 19-foot Piqua blower we assume that you mean the blower delivers 19 cubic feet of air per revolution. That in itself means nothing unless the number of revolutions per minute is given.

Rules governing the melting of iron have been fairly well standardized and are based on the following: The melting capacity of a cupola may be reckoned approximately as 10 pounds per hour for every inch of horizontal area at the melting zone. The area of a 48-inch diameter cupola on this basis is roughly 2000 inches and therefore the melting capacity is 20,000 pounds per hour. Air to the extent of 30,000 cubic feet is required to melt one ton of iron, therefore 300,000 cubic feet will be required to melt 10 tons. This means that a fan capable of delivering 19 cubic feet of air per revolution will have to run at the rate of 300,000 ÷ (60 x 19) — 263 revolutions per minute. Burned coke leaves a certain amount of ash which should be removed from the cupola if the heat runs over 1 hour. The amount will vary to a certain extent depending on the quality of the coke and some furnaces will run longer than others, but a fair rule to apply is the foregoing, one hour for the elapsed time.

In your case we should suggest first that you assure yourself that the fan is capable of delivering the required quantity of air. Cast and install a new set of tuyeres with the inner ends flared to about 12 inches. Your bed is about the right height, but your coke and iron charges are too heavy. Theoretically 10 pounds of iron may be melted with 1 pound of coke, but this only is possible under ideal conditions and where dazzling white iron is not required. The usual method for determining the proper weight of charges is to lay up a ring of firebrick on edge on the charging floor. The ring is made the same diameter as the cupola and is filled with coke. The coke then is weighed or counted by the forkful and the unit adopted as standard. The iron charge is reckoned as approximately 10 times the weight of the coke. On account of the variation in the weight of different brands of coke it is well to experiment to some extent before adopting a permanent ratio. In your case we should start with 2000 pounds of iron and 250 pounds of coke, then note the speed of melting and the temperature of the iron and increase or decrease the ratio accordingly. Oyster shells will serve as a flux but they are no better than limestone, or fluorspar and the choice of either one hinges on the relative price and results attained. Whichever flux is used it should be added in sufficient quantity to produce a thin, liquid slag and the slag should be drawn off steadily during the time of the heat.

Sandpaper Used To Finish Patterns

BY WALTER C. EWALT

APPRENTICES in the patternshop often think that sandpaper is used only to cut wood to size, but with the exception of sandpaper used with sanding machines, the material is not employed for that purpose. Sandpaper may be considered as a finishing tool, its chief use being to make a smooth surface on wood by cutting away tool marks and fibers of wood projecting from the surface. Sandpapering the wood leaves a smooth surface on which to apply the shellac. It is best to leave all sandpapering until the last operation, since if any work is done by sharp tools, such as planes, chisels, etc., on the wood that has been sanded, the sand which has broken away from the paper and entered the pores of the wood, will dull the tools.

Sandpaper, also called garnet cabinet paper, comes in sheets 9 x 11 and the size of the grit is designated by numbers ranging from 0000 to 3½. Patternmakers chiefly use sizes from 00 to 1½ inch size, and of these sizes No. ½ probably is used most frequently for the first rubbing and No. 0 or 00 before shellacing. The 9 x 11 sheets may be purchased in half ream and full ream, a ream equaling 480 sheets. Garnet paper also may be obtained in rolls of 50 yards each, which often are found economical.

A fine rubbing down material may be secured by rubbing two pieces of sand paper together to remove the rough grit and adding a few drops of linseed oil to avoid scratching the wood. When sandpapering a flat surface, a rubbing block should be used, the block being made from a 1 x 2½ x 4-inch piece of pine. For concave or convex surfaces a block may be made of about ½ x 2½ x 4-inch pine on which a piece of leather is glued. When the glue has dried cuts may be made in the wood, with a circular saw, about ⅛ or 3/16 inch apart and within ⅛ or 1/16 inch of the leather. This will make the block flexible.

If sandpaper is folded with the sand side in, it will cut straighter than if folded with the paper side turned out. If the sandpaper is chalked on the back or paper side, it will not slip as easily when holding it under the hand.

Steel Castings Scab in Green Sand Molds

Question—At present we are having difficulty in producing some of our steel castings in green-sand or skin-dried molds on account of scabbing. Our molds are made in solid iron flasks and jolt rammed, rolled over and drawn on pneumatic molding machines. Our flat back work seems to give the most trouble, but we find that when we have room to dry a cope in the core oven the resulting casting will be perfect. Before putting up an additional drying oven we should like to have an expression of opinion from others having experience in that line and whether the proportion of saved castings directly treaceable to drying the molds will compensate for the extra cost involved.

Answer—You do not say whether your castings are large or small and therefore it is impossible to furnish a specific answer. The almost universal practice at the present time is to pour all small steel castings in green-sand molds and no trouble is experienced provided the sand is of the proper grade and prepared in a suitable manner for the molders' use. The fact that your castings scab when poured under green-sand copes and present a perfect surface when the copes are dried, would seem to indicate that your molding practice is at fault. Your sand may be too wet, rammed too hard or not sufficiently vented. Usually if the sand is *open*, little or no venting is required, but if the sand is *close* it will be necessary to

use the vent wire freely. With the inexperienced or even semi-skilled help, one or even all three, of the foregoing conditions may obtain. Local conditions and the class of help available frequently are deciding factors in the problem of whether it is a more economical measure to dry all the molds, or to pay several highly skilled, practical men to supervise operations in green sand. Each one is individual.

The molds for large steel castings practically without exception are made of dry sand, but the reason underlying the custom is the same as that which influences the foundryman making large iron or brass castings. The expense involved in making a large mold is too great to risk a loss owing to some trifling cause like a damp or hard spot in the face of the mold. A dried mold is not liable to distortion from the actual weight of the metal and the strain incident to pouring, to the same extent as a mold made in green sand. The dried face will resist abrasion from the flowing stream of metal and the fusing action better, and produce a cleaner surface on the casting than when made of green sand.

Discuss Cast Iron Pipe Standardization

AT A recent conference on standardization of cast-iron pipe, a number of important subjects were discussed by representatives of practically all interests concerned in standardization along this special line. It was voted at this conference that the sectional committee in preparing specifications covering cast-iron pipe should include the methods of manufacture in-so-far as they may be necessary to secure satisfactory results.

The difficulty of stocking the large variety of sizes and classes of pipe, the importance of international agreement, and the necessity for distinguishing between cast-iron, pressure pipe and other types were the factors influencing this move for uniformity.

It was unanimously voted that the American Gas association, American Society for Testing Materials, and American Water Works association, be recommended to the American Engineering Standards committee as joint sponsors for this project. Each sponsor organization will name a representative to a steering committee which will handle executive duties in the preliminaries of the work.

The two principal and most extensively used types of cast-iron, pressure pipe for conveying water, gas, oil, steam, etc., are the *bell and spigot* and *flanged;* the word pressure being used to distinguish it from the light weight and small sizes of cast-iron soil pipe.

The most widely recognized standard bell and spigot pipe for water, is the American Water Works association standard, adopted May 12, 1908. Prior to the adoption of this standard, the manufacture of cast iron bell and spigot pipe followed specifications issued by the New England Water Works association, adopted as a standard, Sept. 10, 1902, and specifications covering dimensions and weights by individual pipe manufacturers.

The pipes in the American Water Works association standard vary in sizes from four inches to 84 inches, and are made in classes designated by letters *A-B-C-D-E-F-G* and *H*, each class denoting strength for an additional working pressure of 100-foot head, or 43 pounds per square inch. Thus a class *C* pipe is good for 300 feet head or 129 pounds pressure per square inch.

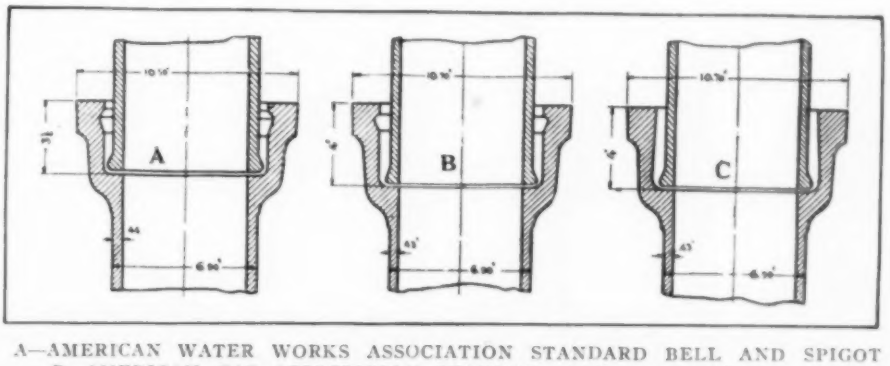
The 4-inch size is made in four classes: *A, B, C,* and *D* with two outside diameters, a variation in the thickness of the pipe being made to denote the class and pressure for which the pipe is designed. The 6-8-10-12-14-16-18 and 20-inch sizes are made in eight classes with four outside diameters for each size; thus two different classes of pipe may be made from one pattern by varying the diameters of the cores. In the larger sizes, there is only one diameter for each size and class of pipe.

The pipe in classes *E, F, G,* and *H* usually are referred to as high pressure, and used only for special services, whereas the class *B* pipe is the most popular and the best seller.

The specification provides that the pipe be cast in dry sand molds in a vertical position and with the bell end down, in sizes 18 inches and above. The smaller sizes may be made with the bell end either up or down. Furthermore, the pipe must be subjected to a hydrostatic test of 300 pounds per square inch in sizes 20 inches and smaller, and in the larger sizes from 150 to 300 pounds depending on class. A section through the bell of a 6-inch, class *A*, pipe is shown at *A* in the accompanying illustration. From this will be seen the relative small clearance between the outside diameter of the spigot and the inside diameter of the bell, also the space formed between the outside diameter of the pipe and the inside diameter of the bell to receive the oakum and lead. The shape of the lead groove and its relatively close location to the face of the bell also is indicated.

The standard length of the pipe is specified to be not less than 12 feet, which is the length commonly manufactured, although the 16-foot pipe in the small sizes also is recognized as standard. Although the bell and spigot type of the A. W. W. A. standard pipe is used principally for underground water mains, of course, it may be used for conveying any other fluid provided the joint and the pressures are suitable.

The bell and spigot cast iron fittings in the American Water Works association standard are made to correspond with the pipe in-so-far as the dimensions of the bells are concerned, although up to and including 12 inches, there is only one class of fitting known as class *D* with the outside diameter of the fitting the same as the outside diameter of the class *D* pipe, and the thicknesses of the bodies corresponding in the same manner. From 14 to 24 inches inclusive, two classes are provided known as class *B* and *D* and from 30 inches and up, there are four classes *A, B, C* and *D* with the body thickness and outside diameters corresponding to the same class.



A—AMERICAN WATER WORKS ASSOCIATION STANDARD BELL AND SPIGOT B—AMERICAN GAS ASSOCIATION STANDARD BELL AND SPIGOT C—AMERICAN GAS ASSOCIATION STANDARD CEMENT AND COMBINATION JOINT

The recognized standard of bell and spigot, cast-iron pipe for gas is the American Gas association standard, adopted October, 1913, by the American Gas institute, and revised by the American Gas association to 1922. A section through the bell of a 6-inch pipe is designated as *B* in the accompanying illustration. This standard covers sizes from four and 18 inches in diameter, and with the elimination of the 14 and 18-inch sizes, follow the size scale of the A. W. W. A. standard. There is only one class for each size and the outside diameter is made the same as the outside diameter of the class *A* pipe in the A. W. W. A. standard.

The thickness of the bodies of the pipe is nearly equal to the A. W. W. A. standard, although not the same; in most sizes it is somewhat smaller. A comparison of the body thicknesses in the two standards is shown. The lead space and the depth of the bell also are somewhat larger in the American Gas association standard than in the A. W. W. A. and the design of the lead grooves is entirely different. The weight of the bell is somewhat lighter in the former standard than in the latter, due to a thinner section of the bell, although the width of the face of the bell is nearly alike in both standards.

In common with the A. W. W. standard, the American Gas association specifies the pipe to be made vertically in dry sand molds, and in most other respects the two specifications are nearly identical. However, the gas pipe is not coated. A comparison of the full length weights of the class *A* pipe in the A. W. W. A. standard with the weights of the American Gas association discloses an almost negligible difference.

A recent revision of the American Gas association standard provided the addition of another type of joint known as the cement and combination joint. The principal difference in the design of the bell between the regular joint and the cement joint lies in the depth of the bell, the elimination of the lead groove, and in somewhat larger inside diameter at the bottom of the bell than at the top. *C* designates the section through the bell of the new joint.

The bell and spigot fittings in the American Gas association standard, like the pipe, are made in only one class for each size. They are made to conform to dimensions of the pipe, and, therefore, are considerably lighter in weight than the A. W. W. A. standard, requiring an entirely separate set of patterns. For example, a 10-inch, B. & S. ell, with a body thickness of 0.49 inch in the American Gas association standard, weighs 198 pounds, whereas the same size and kind of fitting in the A. W. W. A. standard with a body thickness of 0.68 inch weighs 278 pounds. The wide variation in weight also is due to the latter fittings having longer center to spigot and center to bottom of bell dimensions than the American Gas association standard.

Announce Institute of Metals Program

Arrangements for the autumn meeting of the Institute of Metals, which will be held in London Sept. 8 to 11, have been completed. The program committee under the chairmanship of Sir John Dewrance, will have a large number of American contributions. On Sept. 8 the third annual autumn lecture will be given by W. M. Corse, of the National Research council, Washington, on "Recent Developments in Nonferrous Metallurgy in the United States, with Special Reference to Nickel and Aluminum-Bronze." This lecture will be illustrated by films and lantern slides. On the mornings of Sept. 9 and 10, the general meetings will be held at the Institution of Mechanical Engineers where a selection of papers will be presented in abstract and discussed. Visits to various works in the vicinity of London have been arranged, including the Royal arsenal, Woolwich; the Royal Mint, Tower Hill, London; Dewrance & Co., Great Dover Street, London; Fry's Metal Foundry, Blackfriars, London; J. Stone & Co., Ltd., Charlton works; and United Glass Bottle Manufacturers, Charlton.

The following papers will be read:

"A Method for Measuring Internal Stress in Brass Tubes" by Robert J. Anderson, Boston, Mass., and Everett G. Fahlman, Cleveland, Ohio;

"The Application of the Ideal Solubility Curve to the Interpretation of Equilibrium Diagrams in Metal Systems" by D. H. Andrews and Prof. John Johnston, New Haven, Conn.;

"Seventh Report to the Corrosion Research Committee of the Institute of Metals" by Guy D. Bengough and R. May, London;

"Comparative Results on Copper-Silicon-Aluminum and Other Aluminum Alloys as Obtained on Separately Cast Specimens cut from a Crankcase Casting" by E. H. Dix, Jr., and Lieut. A. J. Lyon, Dayton, O.;

"The Determination of Sodium in Aluminum" by D. M. Fairlie and G. B. Brook, Kinlochleven, Scotland;

"The Extrusion of Brass Rod by the Inverted Process" by R. Genders, Woolwich, England;

"Investigation of the Effects of Impurities on Copper. Part II—The Effects of Iron on Copper" by D. Hanson and Grace W. Ford, Teddington, London;

"The Relationship between Tensile Strength, Temperature and Cold-Work in Some Pure Metals and Single Solid Solutions" by Douglas H. Ingall, Wednesbury, England;

"On the Effect of Progressive Cold-Rolling on the Brinell Hardness of Copper" by H. Moore, Woolwich, London;

"Experiments on the Working of Nickel for Coinage" by Sir Thomas K. Rose and J. H. Watson, London;

"Some Experiments on the Effect of Casting Temperature and Heat-Treatment on the Physical Properties of a High-Tin Bronze" by Francis W. Rowe, Manchester, England;

"Some Experiments on the Influence of Casting Temperature and Mass on the Physical Properties of Admiralty Gun-Metal" by Francis W. Rowe;

"Studies in the Aluminum-Zinc System" by Tomojiro Tanabam Osaka, Japan;

"Metal Spraying and Sprayed Metal" by Henry T. Turner and W. E. Ballard, Birmingham, England.

Organize New Merger of Pipe Makers

The Alabama Pipe Co. has been organized at Anniston, Ala. with Thomas E. Kilby, former governor of the state, as chairman of the board, W. F. Johnston, president, C. A. Hamilton, vice president and general manager, all of Anniston; William Byrd, Chicago, director; Whitfield Clark and T. H. Collins, stockholders and directors. Either by direct purchase or control of 14 soil pipe and fittings plants and one water pipe plant in Alabama and Tennessee are included in this organization, it is stated in local industrial circles.

The Alabama Pipe Co., when fully organized, will be the one of the largest mergers or consolidations in cast iron pipe manufacture that has occurred. It is estimated the new organization will have properties worth in the neighborhood of $5,000,000. Economies in operation will be attained by virtue of the one management. No outside financial aid has been sought, nor any bonds sold. When completed the company will be an Alabama proposition.

Companies which are to be included in the holdings of the Alabama Pipe Co. are: Coosa Pipe & Foundry Co., Gadsden Pipe Co. and Agricola Pipe Co., Gadsden; Talladega Pipe Co., Talladega, two plants; Imperial Pipe Co. and Superior Pipe Co., Bessemer; Ornamental Foundry Co., Standard Foundry Co., (one soil pipe and one water pipe plant), Alabama Pipe & Foundry Co. and Union Foundry Co., Anniston; and Rabe Pipe & Foundry Co., Chattanooga.

Recently the Gulf States Pipe Corp. with offices at Anniston, a strictly selling agency handling soil pipe and fittings, announced its formation with Whitfield Clark as president. Several pipe shops are controlled by this company. A statement has been isued in which the output of the following plants is covered: Amory Foundry Co., Anniston; Independent Soil Pipe Co., Anniston; the Southern Pipe & Foundry Co., Knoxville, Tenn.; Kilby Pipe Co., Birmingham; Rudisill Soil Pipe Co., Anniston; Southern Pipe Foundry Co., Birmingham; Interstate Foundry Co., Anniston.

The officers and stockohlders of the Gulf States Pipe Corp. are practically the same as in the Alabama Pipe Co.

Milestones in Foundry Progress

As Recorded in the September Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

THE FOUNDRY finds itself two years old and with this issue enters upon its third year. * * * But just about this time the whole country became overrun with a financial epidemic * * * causing the early death of thousands of infant industries. Thanks to the best of constitutions * * * THE FOUNDRY suffered little.

This was the issue of Sept. 10, 1894, *broadcasting.*

* * *

Those who remember the panic of 1893 state that business disturbances within the past ten or twenty years were, comparatively, as mild as a rough house in an old ladies home.

* * *

John T. Bramhall wrote the lead article in this issue, commenting upon shop conditions and employment at the Pullman works, Chicago.

* * *

G. B. McDonald, Jefferson Iron & Brass Foundry, Jefferson, Tex., wrote explaining how the scarcity and high price of coke had led to the adoption of a mixture of coke and charcoal for cupola melting.

* * *

Evidently this was before the price of charcoal was forced upward by the demand from manufacturers of eyebrow pencils.

* * *

The *Chicago Tribune* of Sept. 2 furnished amusement through its account of a fire at the foundry of Cribben & Sexton, when, "one of the furnaces became overheated and the fluid metal set the cupola on fire."

* * *

Henry Cribben of the firm mentioned had some decided opinions on apprentice training, which he voiced at a meeting of the National Association of Stove Manufacturers in Chicago. He favored a two months trial service before indenturing apprentices. He advanced many thoughts on the training and payment plans, which were heartily seconded by *Como* in the regular *Krank's Korner.* He said, "* * * *manufacturers instead of wasting their time deploring about the scarcity of efficient workmen, should start in and prepare to turn out efficient mechanics themselves.*"

Faked Foundry Facts

Pouring

Think of all the royalties Como might have collected, had he only seen to his copyright on that advice and then watched the foundry literature for the next thirty years!

* * *

S. T. Johnson, general agent of the Whiting Foundry Outfitting Co., visited the editor in Detroit.

* * *

Come again Sam!

* * *

No. 2 pig iron continued to bring from $11.00 to $11.50, Pittsburgh.

JOHN A. PENTON became head of the Iron & Steel Press Co., the organization which issued The Iron Trade Review and The Patternmaker in addition to his original paper, THE FOUNDRY, *started in Detroit and later removed to Cleveland.*

* * *

An English correspondent gave 0.191 tons for iron and 0.56 for brass as the average amounts of sand required to make a ton of castings.

* * *

Northern furnaces were selling iron at $11.50 to $12.00 a ton, while No. 2 foundry was selling in the south at $9.50, furnace.

* * *

The newly organized British Foundrymen's association at a meeting held in Manchester elected Robert Buchanan, president and F. W. Finch secretary and treasurer. Percy Longmuir contributed a paper on the microstructure of metals.

* * *

The Cleveland Foundrymen's association picnicked at Brady's lake, near Akron, and Wm. H. Nicholls, Hill Clutch Co., won the boat race. Charles Ahrens, Bowler Foundry Co., rendered several songs after the lunch, while Michael Cahill, City Foundry Co., won the fat men's race. Hugh Mackenzie, American Shipbuilding Co., was president and John Ryan, Kilby Mfg. Co., was vice president of the Cleveland group.

* * *

Among the popular songs at this picnic was one entitled, "Down Where the Wurzberger Flows." Doubtless this was an old German folk song and referred to some tributary of the Rhine or Oder Bruch rivers.

* * *

David J. Matlack who for 55 years had been superintendent of the iron foundry of the Cramp Shipbuilding Co., Philadelphia, died at the age of 73.

George C. Matlack, son of the veteran mentioned, at present is in charge of the Cramp foundries.

ALFRED E. HOWELL, president, American Foundrymen's association adorned the first page of the Pre-Convention issue of THE FOUNDRY, *September,* 1914, *while G. H. Clamer, this year's president of the A. F. A. was presented in his role as president of the Institute of Metals. Those organizations with the foundry foremen's association and the exhibition company met in Chicago during that month.*

* * *

The General Fire Extinguisher Co. had just completed a two-story foundry at Providence which was described in that issue.

* * *

H. H. Miller, writing from Mexico told of melting brass scrap consisting of empty rifle and artillery shell.

(*Concluded on Page* 701)

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We March Past Another Milestone

THIRTY two years ago this month THE FOUNDRY made its initial bow to the casting industry and modestly outlined a platform upon which it proposed to conduct its activities. In the years that have elapsed since that time it has attained an enviable position in the field covered by technical publications, a position due in large measure to a well defined and appropriate editorial policy. The material presented in its pages has borne the stamp of authority, reliability, impartiality and integrity. Its readers regard it in the same light that an ordinary person regards a competent, well informed, upright person of his immediate acquaintance; one whose opinion he respects and one to whom he confidently turns for an honest and expert opinion on his peculiar problems.

In this connection it is interesting to note the manner in which THE FOUNDRY has kept step with the industry during all the years of its existence. Perhaps it would be more appropriate to say that it has kept one step ahead of the industry. It has served as a general broadcasting station and has brought methods and processes to the attention of foundrymen that without its aid they would not have learned in many years.

The gradual change that has come over the foundry industry both in its personnel and methods clearly is reflected in the editorial columns of this publication and among other things goes to show how closely and intimately the paper has maintained its contact with its readers over such an extended period. Many of the original subscribers still are on the list and several of the original advertisers still are using its pages to direct attention to the products they manufacture or are prepared to supply.

In the early days of THE FOUNDRY its readers almost exclusively were molders. Some of the men were engaged actively in charge of operation as foremen and superintendents, but they all were practical men and the material presented in the columns was designed to appeal directly to their interest in methods, rigging and equipment. The personal note also was strongly stressed. Gradually the scope of its activities was broadened and still keeping in step. THE FOUNDRY presents material in its editorial pages which appeals to every class of men connected with the casting industry in ferrous and nonferrous metals.

The problems of the molder still receive consideration, but a considerable portion of the editorial space is devoted to the problems confronting the foundry owner, manager, superintendent, foreman, metallurgist, the purchasing agent, the employment manager, the cost clerk, melter, cleaning room supervisor and patternmaker. Recognition is taken of the fact that the front office plays an important part in the conduct of the plant, even if the inmates do not wear overalls and probably could not tell the difference between a pop gate and a whistler. The front office men spend the money. They may have to accept the opinion of some man in the shop in regard to what is required in the way of supplies and equipment, but they have the last say in whether an actual check is drawn or not. Informative articles published from time to time bearing on their peculiar and individual problems indicate the extent of the field covered.

The slogan "Wherever metals are cast you'll find THE FOUNDRY" might be amplified to read. "If you want information on any conceivable angle of the casting business you'll find it in the THE FOUNDRY."

Trade Outlook in the Foundry Industry

GRADUAL improvement in foundry conditions is at hand, the low point in operations having been passed with the close of July. While the pickup by no means is sensational, the fact that betterment is noted in orders and that inquiries are more prevalent and of a more insistent character serve to support a feeling of optimism among foundry operators. This inclination is reflected in slightly increased interest in raw material purchases and in firmer prices on iron, particularly in the northern market. Buying has been desultory since early June, but has strengthened during the closing weeks of August.

Better Tone Encountered

According to a report of the National Purchasing Agent's association the consumption of coal for industrial purposes decreased only 1½ per cent in July, in comparison with June. Probably the daily average would show that July marked the turning of the corner, for the holiday resulted in cessation of work for several days on the part of many manufacturies and thus pulled down the total. Coke production showed a marked decrease in July, but the coke market again is active with the resumption of foundry operations. Advancing security and commodity prices, coupled with increases in employment totals have induced a hopeful attitude among manufacturing and commercial interests. Agricultural implement makers are encouraged by the advance in farm product prices, and purchases of steel presage increased demand for castings from these sources. Retail sales which usually precede any marked change in the industrial situation are increasing and merchants expect a fair volume of fall buying. Statistics of the National Industrial Conference Board show that unemployment figures are declining, and indicate that the shortage of jobs is confined to the larger centers.

Prices for Raw Materials for Foundry Use

CORRECTED TO AUG. 22

Iron		Scrap	
No. 2 foundry, Valley	$19.00 to 20.00	Heavy melting steel, Valley	$18.00 to 18.50
No. 2 southern, Birmingham	17.50 to 18.00	Heavy melting steel, Pitts.	17.50 to 18.00
No. 2 foundry, Chicago	20.50	Heavy melting steel, Chicago	15.50 to 16.00
No. 2 foundry, Philadelphia	20.76 to 21.76	Stove plate, Chicago	16.00 to 16.50
No. 2 foundry, Buffalo	19.00	No. 1 cast, Chicago	19.00 to 19.50
Basic, Valley	19.00	No. 1 cast, Philadelphia	17.50 to 18.50
Basic, Buffalo	19.00	No. 1 cast, Birmingham	15.00 to 16.00
Malleable, Chicago	20.50	No. 1 cast, Buffalo	17.00 to 17.50
Malleable, Buffalo	19.00	Car wheels, iron, Pittsburgh	17.00 to 17.50
		Car wheels, iron, Chicago	17.00 to 17.50
Coke		Railroad malleable, Chicago	17.50 to 18.00
Connellsville foundry, coke	$4.00 to 4.50	Agricultural mal., Chicago	16.50 to 17.00
Wise County foundry, coke	4.50 to 5.00	Malleable Buffalo	17.50 to 18.00

Auto Output Improved

Operating schedules of the majority of automobile plants are being expanded in anticipation of better business for the remainder of the year. Price advances serve as a further indication of this belief. According to statistics of the department of commerce, July showed an upturn in automobile production with a total of 262,876 cars manufactured, against a June total of 245,817. This gives an increase for July of 17,059 cars or about 7 per cent. Last year's July output was 328,105, but that of July, 1922 was only slightly ahead of this year with a total of 247,186 cars. However, the output of the past month was far below the March production when a peak was registered of about 382,500 cars. The drop has continued steadily since that time until June marked the turning point. Orders for automotive castings again are coming to the foundries and a continued improvement is expected throughout the fall, inasmuch as stocks of castings in the hands of automobile manufacturers are reported to be low. Trucks and tractors follow closely the trend in passenger automobile manufacture, the former remaining about 10 per cent of the total of the pleasure car class.

Building Declines

Building construction registered another decline in July, dropping 14 per cent below the June figure according to the building awards scheduled in 27 northeastern states. However, the past month was only 3 per cent below July of last year. An interesting condition is reflected in the tabulation of building awards. The shrinkage in residence construction is marked, a decline of 24 per cent being shown by July, which recorded only about half as much residence construction contemplated as March of this year. Industrial projects also declined in July to the smallest total since September, 1921 when industry still was stagnant as a result of business depression. However, during the last of July and in early August, industrial construction again has taken an upturn which probably will be stimulated by the revival in plant operations. Building prices are slowly receding. The same is true of prices on plumbing fixtures and on building hardware. Stove and furnace foundries report business fair with prospects good for increases in the fall. Pipe shops still have a comfortable backlog of orders and buying is quickening. Gray iron jobbing shops in the St. Louis district note an increase in orders and inquiries are much improved. Again in freight car loadings is noted throughout the country and a heavy increase is predicted in August when coal movement begins in earnest. Freight car orders show an increase, although buying still is light. Improved business in the northwestern roads, coupled with the increased demands of grain movement is expected to develop new car orders. Steel castings orders struck a new low level in July, according to the department of commerce. Seventy identical companies with a total monthly capacity of 100,700 tons showed orders for only 37,339 net tons in July against 48,718 tons in June and a peak of 100,514 tons in March. The July bookings represented only 37.1 per cent of capacity against 48.4 per cent in June and 99.8 per cent in March. Railway shops lead with 40.3 per cent.

Brass Shops Optimistic

While brass foundry operations are not all that could be desired, improvement is noted. Nonferrous prices based on New York quotations in the *Daily Metal Trade* of Aug. 22, follow: Casting copper, 13.25c; electrolytic copper, 13.40c to 13.45c; Straits tin, 53.25c; lead, 8.25c to 8.37½c; antimony, 10.50c; nickel, 30.00c; aluminum, No. 12 alloy, remelt, 21.00c to 21.50c. Zinc is 6.67½c, E. St. Louis, Ill.

Personal

Larry J. Barton has been appointed metallurgist and director of foundry research work by the Ohio Steel Foundry Co. with plants at Lima and Springfield, O. Mr. Barton entered upon his new duties Sept. 1, 1924. Mr. Bartin was born in San Francisco, May 21, 1892, receiving his early education in San Mateo, Cal. He was graduated from Leland Stanford university after completing a 5-year course in chemical engineering. Since that time, he has held executive positions in western and southern foundries, and has had a wide field of experience in the production of steel castings, which especially fits him for his new position. His most recent connection has been with Dibert, Bancroft & Ross Co., New Orleans, where he resigned to accept the Ohio position. Mr. Barton's articles under the title of "Refining Metals Electrically", now are appearing in THE FOUNDRY.

Acheson Smith, vice president and general manager, Acheson Graphite Co., Niagara Falls, N. Y., has been elected a director of the American Management association, New York.

Ralph F. Miller, formerly service engineer of the United Engineering & Foundry Co., Pittsburgh, has been appointed chief engineer of the R. S. Newbold & Son Co., Norristown, Pa.

Sam Tours, metallurgist, Doehler Die-Casting Co., has removed his headquarters from the Brooklyn plant to the foundry at Batavia, N. Y., where he will carry on and direct work as previously.

Walter Broadhurst has been made foreman of the Graff Furnace Co., Scranton, Pa.

Ratio of Good Castings To Total Melt

Question: We make a general line of gray iron castings for agricultural machinery and are interested to know if our shrinkage percentage, coke ratio, and percentage of good castings are running above or below the general average for this line of work. The amount of material charged in the cupola for a month follows: Coke, 98,750 pounds; limestone, 7170; pig iron, 230,300; cast iron scrap, 185,060; steel scrap, 10,100; return shop pigs, 27,595; cupola drop, 17,245.

For the same month we had the following returns: Good castings, 342,476 pounds; bad castings, gates, 64,521; cupola drop, 17,245; shop pigs, 27,020.

You will note that our furnace loss was 19,238 pounds, or 4.09 per cent. The ratio of metal to coke was 1 coke to 4.76 pounds iron, while the percentage of good castings was 72.8. Does semisteel show a greater furnace loss than ordinary gray iron?

Answer: Your return of 72.8 per cent of good castings on a line of general agricultural castings is above the average and represents good cupola and molding practice. Many of these castings are small and the gates outweigh the castings. Your loss of 19,238 pounds representing the difference between the total amount of iron charged and the total amount recovered is almost 5 per cent and that is regarded as normal. Your coke to iron ratio, 1 to 4.76, might be regarded as high under certain circumstances, but in your case where exceedingly hot iron is required on account of thin sections and long distances to which the iron must be carried, the heavy coke ratio probably is justified. If you have not experimented, we suggest you try a little heavier charge of iron leaving the coke as it is. The furnace loss on semisteel is greater than on ordinary gray iron, where steel is used in excess of 10 per cent and where the steel scrap employed is in the form of thin sheets or clippings.

Death of Luther A. Roby

Luther A. Roby, a well known foundryman and engineer, died Thursday, Aug. 14, 1924, at his home, 2650 Colchester Road, Cleveland. He was born in Nashua, N. H., in 1853. Here he received his early education, and was graduated from the Massachusetts Institute of Technology, Boston, receiving a degree in mechanical engineering in 1875. After leaving the institute, he entered the employ of the Nashua Iron Co. during which time he received valuable practical instruction and became associated with S. T. Wellman, who later removed to Cleveland and became connected with the Otis Steel Co. Mr. Roby came to Cleveland shortly afterwards and entered the employ of the Otis Steel Co. as draftsman remaining 25 years during which time he rose to the position of general superintendent. He was forced to resign this position owing to ill health.

Mr. Roby devoted the following 5 years to house construction work which kept him out in the open, and enabled him to regain his health.

He then entered the employ of the Wellman-Seaver-Morgan Co., Cleveland. Mr. Roby's first position with the firm was that of engineer in charge of construction and during the time he held this position he supervised the erection of a number of large pieces of engineering equipment. During the year 1904, he erected a complete rail mill for the Dominion Iron & Steel Co., Ltd., Sydney, N. S., which is now one of the component parts of the British Empire Steel Corp. He also installed the rail mill in the Algoma Steel Co., Sault Ste. Marie, Ontario.

When the Wellman-Seaver-Morgan Co. erected its steel foundry in Cleveland, Mr. Roby assumed charge and held that position up until five years ago when he resigned owing to ill health.

He is survived by his widow, Mrs. Addie L. Roby, three sons, Luther L. Roby, Harold P. Roby and Frank Roby, and a daughter, Mrs. Ray Irvin.

Obituary

E. H. Broughall, manager of the Edgewick works and foundries of Alfred Herbert, Ltd., Coventry, England, died recently. He was born in 1870 at Coventry and was educated at a local technical institute. Mr. Broughall was formerly a vice president of the Institute of British Foundrymen which he joined at its foundation, resigning his office last June on medical advice. He was a member of the American Foundrymen's association, of the Institution of Mechanical Engineers and of the Coventry Engineers' society. He was the author of several papers dealing with the effect and use of denseners and the commercial and technical aspect of permanent molds.

Orin H. Davis, vice president and superintendent of the Kanawha Mfg. Co., Charleston, W. Va., died recently.

Henry J. Wanner, steel manufacturer, founder of the Wanner Malleable Iron Co., Hammond, Ind., died Aug. 8.

Purchase Foundry in Passaic

The Eagle Iron & Brass Foundry, Passaic, N. J., has been purchased by the Gillespie Foundry Co., Paterson, N. J., and will be operated under the name of William P. Laytham Sons, Inc. The officers of the new company are William B. Laytham, and Allison Laytham, vice presidents, and John G. Brown, secretary.

Pennsylvania was the leading state in the production of brass, bronze, copper and other alloy castings and machinery fittings in 1921, with a total value of $12,348,396. Michigan was second and New York third, the former with $7,038,028, the latter with $6,126,870.

Suggest Placing Weights on Blue Prints

Thomas E. Durban, Erie Forge Co., Erie, Pa., recently wrote Herbert Hoover, secretary of commerce, suggesting that designing engineers put the approximate weight of castings on all blue prints sent out for bids. In his letter, Mr. Durban points out that much time and expense may be saved by jobbing foundries if this practice is followed. He states that all of the weights must be figured when the design is made to get the approximate cost and these weights may be used in all cases where per pound price is quoted, thus saving time in the engineering department of the foundry and greatly expediting quotations. The weights will be of value to practically all foundrymen since it is almost the universal custom to quote per pound prices on the estimated weights on rough castings and on almost all work where no finish is required.

In reply to this letter, R. M. Hudson, chief of the division of simplified practice, department of commerce, states that the department agrees with the suggestion. He also states that while this matter is somewhat outside the scope of the department, it will be glad to co-operate with any group sponsoring this movement among engineers.

Discuss Safety Devices

Safety features will be the chief topic discussed by the congress of the National Safety council which will be held this year at Hotel Brown, Louisville, Ky., Sept. 29-Oct. 3, 1924.

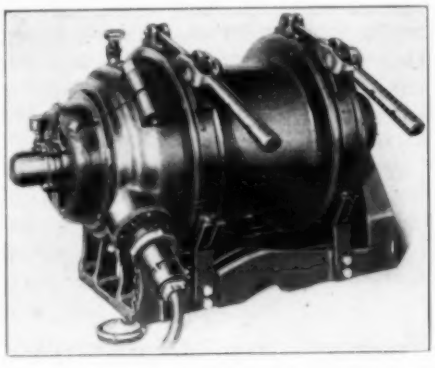
The metal session of the congress will convene Tuesday morning, Sept. 30, 1924 and will be presided over by T. H. McKenney, superintendent of labor and safety, Illinois Steel Co., South Chicago, Ill.

The morning session will open with the report of the officers and committees and the appointment of a nominating committee. Two papers will be presented at this session. The first paper by W. S. Hall, Illinois Steel Co., South Chicago, Ill., will deal with construction operation and maintenance of overhead electric traveling cranes and a paper by A. V. de Forest, research engineer, American Chain Co., Bridgeport, Conn., will discuss the safe operation and use of crane chains.

At the afternoon session a paper will be read by W. E. Watters, National Malleable Castings Co., Melrose Park, Ill., treating on protective devices and clothing for foundry workmen. H. S. Smith, Union Carbide & Carbon Corp., New York and G. O. Carter, Linde Air Products Co., New York, will present a paper at this session dealing with the safe handling and use of cutting and welding gases.

Develop Electric Hoist for Foundry Work

The Sullivan Machinery Co., Chicago, has introduced single and double drum electric portable hoists which are similar in appearance to the compressed air machine of its make. The motor of the electric machine is contained entirely within the drum. In the single drum hoist, the motor is supported at one end of the frame or base and supplies power through reduction gears to the hoisting



THE HOIST IS BUILT WITH EITHER DOUBLE OR SINGLE DRUM

drum, which is 11⅛ inches in diameter and 8¼ inches long. The drum holds 500 feet of 5/16-inch wire cable. The machine is rated at 6½ horsepower and is designed to lift a 2000-pound dead load vertically at a speed of 110 feet per minute on single lines. It is claimed that the pulling power is much greater when pulling cars on moderate grades.

The double drum hoist weighs 780 pounds, is 38 inches long, 15 wide and stands 19 inches high. The electric motor is mounted between the two drums on a central standard, carrying a pinion at each end of the armature shaft, and thus furnishing power through reduction gears to two drums, each of which is 11⅛ inches in diameter and 6¼ inches in length with a capacity of 250 feet each of 5/16 inch wire rope. The right hand or haulage drum has an operating speed at full load, 2000 pounds lifted vertical, or 110 feet per minute. The gearing on the left hand or tail rope drum provides for 160 feet per minute.

P. H. Sackett, 3445 Hennepin avenue, Minneapolis, has been appointed representative in Minnesota, North and South Dakota for the Pawling & Harnischfeger Co., Milwaukee.

Hard Metal Required for Draft Gear Wedge

Question: Do you know of any alloy more suitable than hard cast iron for the wedge in the friction draft gear on a railroad car. The wedge is in contact with 0.40 to 0.45 per cent carbon steel and is subject to a working pressure that varies from 1000 to 10,000 pounds per square inch. Would you recommend the alloys *C* 5 or *C* 10 as given in *Kent's Mechanical Engineer's Handbook*, for the purpose or can you make other suggestions?

Answer: A great deal of experimental work has been done in developing the friction draft gear used on railroad cars and practically every kind of metal has been tried in various combinations for the different parts. Many types of friction draft gear are in use at present, but the component parts in all are steel, cast iron and malleable iron. The two alloys you mention possibly might serve, but since they cost at least five times as much as cast iron and are in no way superior to cast iron for the purpose, their adoption automatically is ruled out. The first *C* 5 is a manganese bronze with a brinell hardness of 150 to 180 and is particularly well adapted to the manufacture of castings in which strength and toughness are the predominant characteristics. The second alloy, *C* 10, is a phosphor bronze widely used in the manufacture of gears, bearings and other castings subjected to heavy wearing service.

Milestones in Foundry Progress

(*Concluded from Page 697*)

1914

Ford Motor Co., Detroit, had inaugurated a continuous foundry which was described at length.

* * *

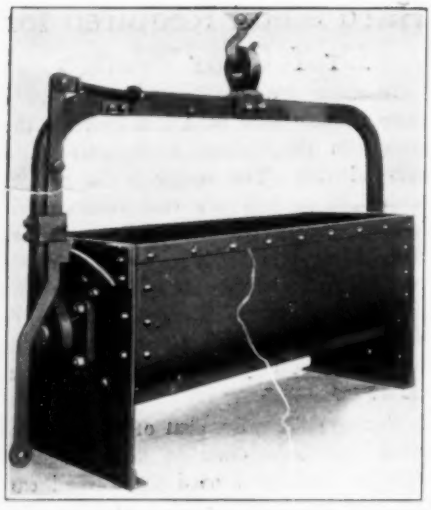
The Ford factory then had an output of 1200 cars per day and its foundry melted about 200 tons per day. No! Direct metal was not used.

* * *

Business conditions were unsettled as a result of the European war, as it then was termed. Equipment sales were numerous and the start of expansion in foundry capacity was noted. No. 2 foundry iron brought $13.90, Pittsburgh, and $10.00 to $10.50, Birmingham.

* * *

The Wilson Foundry & Machine Co., Pontiac, Mich., had been incorporated with $400,000 capitalization by Charles B. and D. R. Wilson, formerly with the Ferro Machine & Foundry Co., Cleveland. These gentlemen still head this large organization.



BUCKET FOR CHARGING MALLEABLE MELTING FURNACE

Steel Treaters To Meet in Boston

The steel exposition which is to be conducted simultaneously with the annual convention of the American Society for Steel Treating at Boston, Sept. 22 to 26, will be 30 per cent larger than the exhibition held at Pittsburgh last year and up to that time the high point of the convention's activities. Last year 79,000 square feet were used, while this year at the Commonwealth Pier, 150,000 square feet will be necessary to accommodate all the exhibitors. A feature of the exhibit will be the displays of machine tool and machinery manufacturers who will occupy an entire section of 25,000 square feet devoted exclusively to machines in operation.

While the final program for the technical sessions of the convention has not yet been announced, the tentative program indicates that a wide range of subjects will be discussed by men prominent in the iron, steel and metallurgical industry. Among the leading metallurgists who will present papers will be Kotaro Honda, professor of physics and metallurgy, Imperial university, Sendai, Japan. Prof. Honda is coming to America expressly to attend the Boston convention and exposition of the society. Several symposiums are to be held during the week, among them being one on "Heating Media, Including Oil, Gas and Electricity" on Tuesday afternoon; one on "Hardness Testing" on Thursday afternoon; and one on "Metallurgical Education" on Friday afternoon.

Among the important papers to be presented during the week are:

"The Law of Depression of Freezing Point as Applied to Metallic Alloys," by Kotaro Honda and Toyato Ishigaki, Imperial university, Sendai, Japan.

"Application of X-Ray Crystal Analysis to Metallurgy," by Dr. W. P. Davey, General Electric Co., Schenectady, N. Y.

"High Power Photomicrography," by F. F. Lucas, Western Electric Co., Hawthorne, Ill.

"X-Ray Testing—Foundry Control," by H. H. Lester, Watertown arsenal, Watertown, Mass.

"Heat Treatment of Carbon Steel Castings," by A. E. White, University of Michigan, Ann Arbor, Mich.

Builds Eye Shield for Grinder Service

An eye shield, which may be attached to any grinding wheel, is being manufactured by the Dries & Krump Mfg. Co., Chicago. The device consists of a glass shield, a flexible arm and fittings either for attachment to wall, post or machine. The glass is mounted on a steel frame and may be adjusted easily. Adjustment to the front or side of the wheel and to any convenient height for the workman is obtained through the flexible arm, the shield remaining in any position. One shield may be used for two wheels on a grinder providing belt guards do not obstruct. The device is furnished complete with adjustable brackets, 18-inch length of pipe, floor flange, street elbow, nipple, lock nuts, 18-inch flexible arm, steel frame and 7 x 9-inch glass. The shipping weight is 6½ pounds.

Facing for Manganese Steel Castings

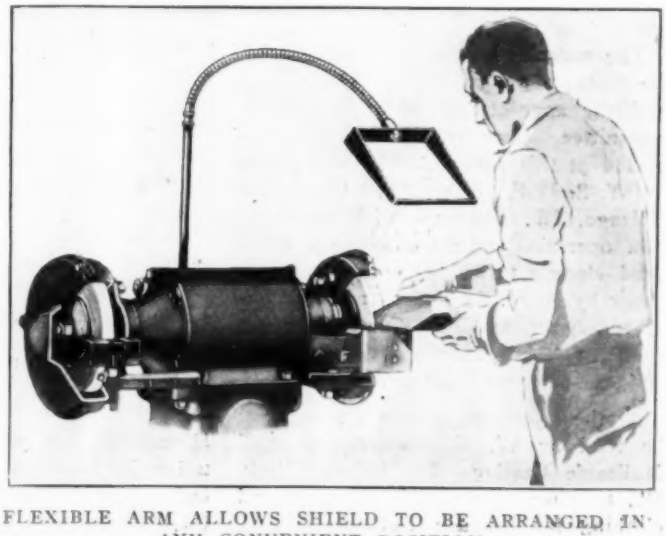
Question: Will you kindly inform me what kind of sand mixtures are used for facing sand and for cores on manganese steel castings. We have been told that these castings require special cores.

Answer: Sand mixtures for facing and core sand vary to some extent in various foundries, depending on the class of castings handled and the source of the available sand supply. A highly refractory silica sand forms the base in both cases and it may be bonded with oil, molasses or practically any of the dry core binders furnished by the foundry supply houses. These houses furnish full directions for employing their particular product and in the majority of cases are prepared to furnish the service of an expert foundryman to demonstrate the manner in which the binder should be added to produce the most satisfactory results. Without exception the sand is mixed in a device of the muller type where the sand is ground in a pan under a single roller or more frequently a pair of heavy revolving iron rollers. Old sand is added to the mixtures in varying amounts depending on several factors, particularly the extent to which the core or face of the mold is surrounded by metal. On plain, flat faces, covering cores and other similar mold surfaces, old sand is used almost exclusively. Interesting articles describing the manufacture of manganese steel castings were published in THE FOUNDRY on Nov. 15, 1923 and on April 1 and April 15, 1924.

Designs Charging Bucket

A heavy standardized steel plate bucket for charging sprue and pig iron into malleable melting furnaces recently has been introduced by the Whiting Corp., Harvey, Ill. The load is dumped automatically when the latch is tripped, the bucket returning to the upright position when empty. The bail is detachable and only one bail is required for several buckets. As shown in the accompanying illustration, the bucket is made with a clear space underneath so that it may be used with lift trucks. The buckets also are manufactured without the lift truck feature or with an apron which may be used to increase the capacity when charging light scrap or sprues. The capacity of the bucket is 3000 pounds of pig iron.

An agricultural implement association has been established in Peking, China, having for its object the investigation of various makes of farm machinery, experimental work, the establishment of implement factories and advising farmers as to the greater use of such equipment.



FLEXIBLE ARM ALLOWS SHIELD TO BE ARRANGED IN ANY CONVENIENT POSITION

Sand Device Measures and Mixes Sand

A new arrangement for mixing sand in the foundry recently has been installed in the plant of the Elmwood Castings Co., Cincinnati. The general layout of the sand bin, mixer and measuring devices is shown in the accompanying illustration. The bin *A* is built on the same foundation as the mixer *B*, the bin being built directly over the mixer. The used sand is reclaimed from the castings poured the previous day. This used sand is brought by overhead cranes from the cleaning department and dumped into the bin. Various grades of new sand are kept in bins *AA* near the mixer.

The operator charges the mixer by operating the lever *H*, which actuates a gate allowing any desired amount of sand to run from the bin *A* into the scale pan *C*. When the proper amount of sand has dropped into the scale pan, the weights at *M*, which previously have been set, cause the scale beams *TT* to rise. This makes an electrical connection lighting the light *N*. The sand then is lowered into the mixer *B* by the operation of a lever *J*. In case the sand does not flow freely, the vibrator *K* is used by turning on the air at *KK*.

The proper quantity of oil and water is measured into the visible containers at the right by opening the valves *GG* and *Q*. The oil container *G* is fed from an overhead tank *E* while the water container *F* is fed from the water line *Q*. The measured quantity of oil and water is allowed to flow into the mixer by opening the valves *FF* and *FE*. The pipe *S*, running around the entire inside circumference of the mixer pan, is perforated to insure a uniform distribution of the oil and water.

After the sand has been mixed thoroughly it is lowered through the trap *BB* into the box *D* which is transported to and from the pit by an overhead crane. The boxes are equipped with trunnions, *V*, for lifting and hooks, *X*, for dumping.

Not only the core sand, but all facing sand used in the plant is mixed at this point and distributed in boxes to all parts of the shop. This arrangement has been found to be efficient and economical, eliminating the guesswork in making mixtures. The foreman sets the schedules of mixtures and by using the weighing pan and the visible containers, the correct mixture may be obtained.

A close check has been kept on the amount of oil used and it has been found that a considerable saving has been realized since installing the measuring devices. It also was found that the percentage of bad castings decreased through the use of a uniform core sand mixture. The oil and water measuring containers were made by the American Oil Pump & Tank Co., Cincinnati, and the plant's millwright department installed the equipment. The mixer was manufactured by the National Engineering Co., Chicago.

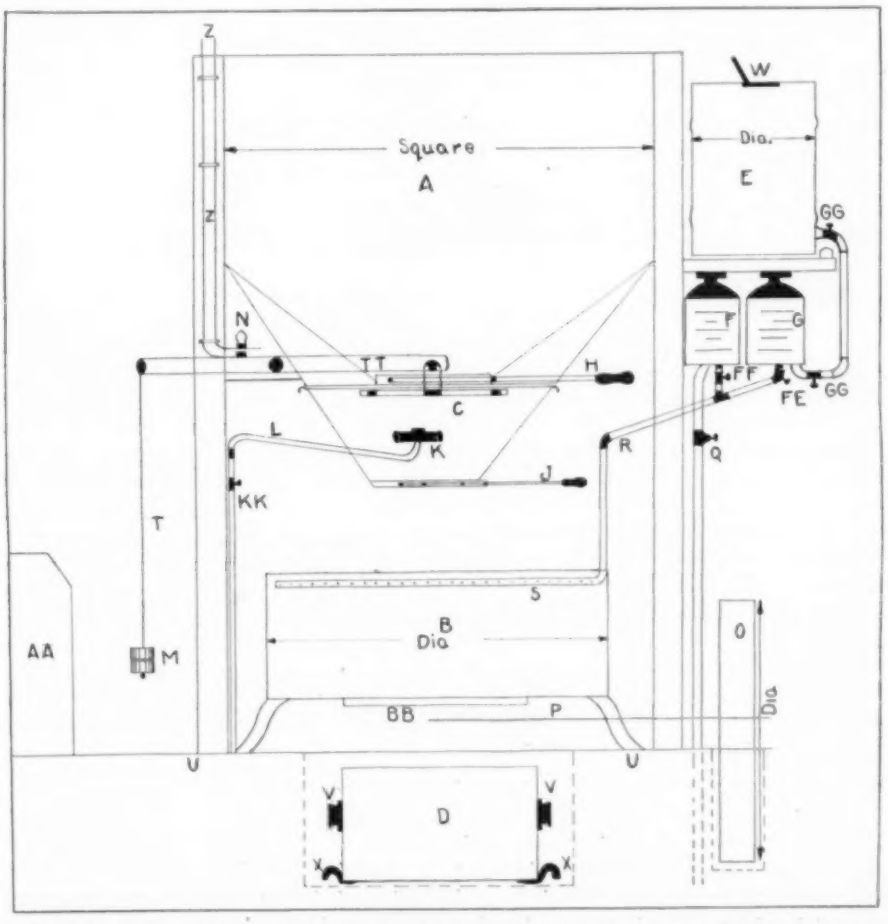
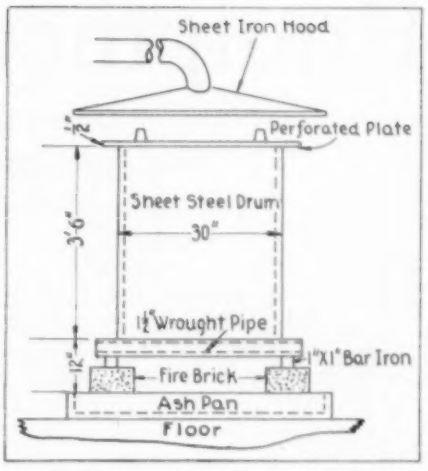


DIAGRAM OF APPARATUS WHICH MIXES THE SAND IN THE PREDETERMINED PROPORTION



A HOOD AND PIPE CARRY AWAY ALL THE FUMES FROM THE COKE FIRE

Simple Foundry Heater

Objection frequently advanced against the open salamander as a heating medium in the foundry has been overcome in the type of device shown in the accompanying illustration. It has been in use for some time in a prominent jobbing foundry and has given excellent satisfaction. A shallow rectangular box cast in an open sand mold serves for a foundation and ash pan. Two square 1-inch bars rest on four bricks, one in each corner of the ash pan. A number of 1½-inch pipes spaced ⅜ inch apart form the grate which supports a boiler plate drum 30 inches diameter and 36 inches high. Except when *firing up* the top of the drum is kept covered by two perforated core plates. A galvanized iron hood hangs suspended about 14 inches above the top of the drum. A short piece of 6-inch pipe connects the hood with a long 10-inch pipe that extends from one end of the shop to the other and terminates in a brick chimney at one end of the building. The hood prevents the obnoxious gases from the fire mingling with the air in the shop and the long pipe serves as a heating medium throughout its entire length. Suitable connections are provided at various points so that the stove may be connected readily at any one of several places if found necessary. The grate is easily cleaned and the air circulation through the pipes ensures long life. Coke is employed for fuel.

Equipment Market Brighter

Increased Orders and Inquiries Cause Optimistic Feeling Among Manufacturers—Buying Confined Chiefly To Larger Shops—Foreign Foundrymen Are Buying American Machines

BETTER feeling is prevalent throughout various distributing centers for foundry equipment. This probably is due to the fact that inquiries have increased substantially during the past two weeks, and also to foundry operations picking up. While the volume of sales was heavier during the past month than in July, which was found by some to be the lightest month of the year, there is much business hanging fire which should be closed in the near future. Cupola manufacturers are finding more new business in the New York territory than has been in evidence since last spring, while plant operations are being increased by an oven maker at Cleveland. Manufacturers state that much of the equipment now being purchased is for the larger foundries, and that a short time probably will elapse before the smaller plants will be buying in any volume. Repair business is increasing to a considerable extent.

Export business is reported as fairly satisfactory. A Cleveland manufacturer has sold molding machines to users in France and Belgium and to the Imperial government railways of Japan. Exports of foundry and molding equipment for June, as reported by the United States department of commerce, bureau of foreign and domestic commerce, totaled $63,031 as compared with $68,368 in May.

Diversified Interests Are Inquiring

WITH September signalizing the end of the vacation season, eastern foundry equipment sellers are manifesting more optimism than in weeks. Both orders and inquiries have been more numerous lately although business is still far from brisk. However, it is expected this improvement will be maintained. Cupola manufacturers report more inquiries than in any time since last Spring, several of which have come out from the New York Metropolitan district. At the same time, there are several active inquiries for electric furnaces, some of which have been pending for a period. The interest manifested in this heavier equipment is regarded as particularly significant, and the forerunner of demand for lighter units.

A recent cupola buyer is Henry Donohue, Yonkers, N. Y., who also has bought considerable other equipment for a new plant. The cupola will have a 76-inch shell. The Newport News Shipbuilding & Dry Dock Co. recently has purchased a sand cutter and some heavy ladles for its plant at Newport News, Va. It now is understood to be figuring on sand-blast equipment. The equipment has been necessitated, it is said, by recent orders for railroad cars.

The Boynton Furnace Co., Newark, N. J., continues to buy equipment for its new plant in Jersey City, its latest purchase being a 3-ton electric crane, placed with the Shepard Electric Crane & Hoist Co. Montour Falls, N. Y. The Trenton Malleable Iron Co., Trenton, N. J., has been a crane buyer, closing on a 5-ton, single I-beam crane, with the same builder. The Smith & Winchester Mfg. Co., South Windham, Conn., has purchased a 7½-ton electric crane from the Northern Engineering Works, Detroit. The order is understood to have been placed through the Aberthaw Co., Boston. While there has been an increase in demand for cranes, competition still is keen among manufacturers, with the result that prices are hovering around the levels that have prevailed during the past several weeks.

The W. W. Sly Mfg. Co., Cleveland, has sold a core sand reclaiming mill and tumbling mill equipment to Frazer & Jones, Syracuse, N. Y.; tumbling mill equipment to the Trenton Malleable Iron Co., Trenton, N. J. and the Hart & Crouse Co., Utica, N. Y. Prospective buyers of equipment include the Reading Foundry & Supply Co., Reading, Pa., which is planning to rebuild the portion of its plant recently damaged by fire, with a loss of $30,000, and the Hale Fire Pump Co., Conshohocken, Pa., which has started work on the erection of a 1-story foundry. It is reported in the east that the Pittsburgh Electric Furnace Corp., Pittsburgh, has sold electric furnaces to the American Manganese Steel Co., for its plant in Los Angeles, the Ford Motor Co., Detroit, and a Milwaukee manual training school. Equipment still is pending for the Maryland state penitentiary at Baltimore.

Cleveland Conditions Better

INCREASED activity among makers of foundry equipment in the Cleveland territory has caused a decidedly better feeling to permeate the trade. The past few weeks has witnessed the closing of several inquiries which have been hanging fire for some time and also the sale of equipment on recent inquiries. Makers of ovens are operating their plants at a much better rate and manufacturers of other lines are finding it much easier to keep their plants running. Several manufacturers have found that the low point in sales was reached in July and that a betterment in sales was evident in August. July, it appears, generally is a poor month in some lines of equipment, although the turnover for that month this year was low in comparison to some other years. Inquiries are being brought out at a much better rate and it is thought much of this business will be closed without undue delay.

Plans now are being drawn for a number of new foundries of good size throughout the country, and the present plant construction is fair. The east and especially New York is leading in the planning of new plants. Where possible, owners are taking advantage of the declines in the cost of building materials.

The F. A. Coleman Co., Cleveland, has sold a large continuous electric drying oven, 24 feet long, 7 feet wide and 7 feet high, for drying pasted and blackened cores, to be installed at the foundry core room of the Ferro Machine & Foundry Co., Cleveland; a continuous type electric oven to the Union Furnace Co., Altoona, Pa.; a rolling drawer type oven to the Westinghouse Electric & Mfg. Co., Springfield, Mass.; and a reverberatory aluminum furnace to the Hoover Suction Sweeper Co., Canton, O.

The W. W. Sly Mfg. Co., Cleveland, has sold sand drying machinery to the Jewell Steel & Malleable Co., San Francisco, tumbling mill equipment to the Erie Stove

& Mfg. Co., Erie, Pa., and the Whitin Machine Works, Whitinsville, Mass., and dust arrester equipment to the Weir Stove Co., Tanton, Mass., and the General Electric Co., Erie, Pa. The Ohio Foundry Co., Cleveland, and the Chapman Valve Mfg. Co., Indian Orchard, Mass., have purchased sandblast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md.

The Ross-Meehan Foundries, Chattanooga, Tenn., is equipping its new steel foundry with a 3-ton furnace and a 5-ton and a 3-ton electric traveling crane. An annealing oven with core ovens and mold baking ovens, to be electrically heated, also will be installed. The annealing oven is to be manufactured by the General Electric Co., Schenectady, N. Y. The Ross-Meehan company expects to have the plant in operation some time in December. G. F. Meehan is general manager.

Practically no new equipment will be purchased by the Rhode Island Malleable Iron Works, Hillsgrove, R. I., for its new foundry now being constructed as the equipment in the old plant will be installed in that being built. Frank D. Chase, Inc., Chicago, is designer.

Chicago Sales Improving

MANUFACTURERS of foundry equipment in the Chicago district continue to encounter much resistance in placing business. However, with both coke and pig iron sales gradually improving, this resistance may weaken shortly. Sales of sand mixers manufactured by the National Engineering Co., Chicago, include units to the Southern Wheel Co., Birmingham, Ala., Ohio Injector Co., Wadsworth, O., and the Ross-Meehan Foundries, Chattanooga, Tenn.

The Hanna Engineering Works, Chicago, has sold an air jolt machine with table 72 x 90 inches to the C. & G. Cooper Co., Mt. Vernon, O., and a jolt ram pattern draw machine to the Rens-salear Valve Co., Troy, N. Y. The Pangborn Corp., Hagerstown, Md., has sold sandblast equipment to the Michigan Lubricator Co., Detroit. The Gale Mfg. Co., Albion, Mich., has purchased a tilted sandblast mill of the positive pressure type and dust arrester equipment and the Chicago Bearing Metal Co., Chicago, has secured tilted sandblast equipment from the W. W. Sly Mfg., Co., Cleveland. The New Castle Castings Co., New Castle, Ind., is contemplating a new foundry. H. A. Stinebrink is in charge of the plant.

Pittsburgh Outlook Brighter

A SLIGHT betterment is reported by sellers of foundry equipment in the Pittsburgh district this week. While orders have not yet assumed a volume satisfactory to sellers, still the trade reports that buying is in line with present conditions that exist in the foundry industry. During the past week sales of foundry iron totaling 20,000 tons were made in this district, and activity in this direction has created confidence in the minds of makers of foundry equipment that better things are ahead. One concern specializing in the sale of foundry supplies reports business entered last week surpassed entries of the two previous weeks. A few other sellers of foundry equipment report that vacations largely are interrupting sales and that the market appears quiet at the moment. During the past week the Whiting Corp., Harvey, Ill., entered an order from the Westinghouse Airbrake Co. for a cupola with a 66-inch diameter shell of special construction. Numerous sales of molding machines have been made, including two for the Southern Manganese Steel Corp., St. Louis, one for the Kennedy Valve Mfg. Co., Elmira, N. Y., two for the International Heater Co., Utica, N. Y. one for the Lebanon Steel Foundry Co., Lebanon, Pa., and two for the Boynton Furnace Co., Jersey City, N. J. The foregoing equipment will be furnished by the Herman Pneumatic Machine Co. As far as can be learned sales of cranes for foundry installation are lacking.

The Vulcan Iron Works, Wilkes-Barre, Pa., has purchased tumbling barrel and dust arrester equipment and the Pittsburgh Malleable Iron Co., Pittsburgh, has closed on dust arrester equipment from the W. W. Sly Mfg. Co., Cleveland. The Pangborn Corp., Hagerstown, Md., has sold sand-blast equipment to the Oberndorf Mfg. Co., Pittsburgh, and a sand-blast and dust arrester installation to the A. Weiskittel & Son Co., Baltimore, Md.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Buda Co., 154th street, Harvey, Ill., operator of a gray iron foundry, will construct a 1-story plant for the manufacture of railroad equipment.

Busch Sashweight Co., after installing equipment in a foundry will move to a building on Willow near Seventh street, Lebanon, Pa.

Wayne Iron Works, Commercial building, Pittsburgh, has awarded contracts for the construcion of a 1-story, 49x174-foot plant.

Rosedale Foundry & Machine Co., Columbus and Preble avenues, Pittsburgh, operator of gray iron foundries, is reported as contemplating purchase of equipment.

Reading Foundry & Supply Co., Reading, Pa., was damaged slightly by fire recently when sparks from the cupola set fire to the large ventilators.

The Acheson Foundry Works, Alton Park, Chattanooga, Tenn., is constructing an addition to its plant. The company operates a gray iron foundry.

Oklahoma Steel Castings Co., Tulsa, Okla., has completed installation of foundry equipment increasing the capacity of its plant about 50 per cent. The present capacity is about 250 tons of steel castings a month. The major part of the output of the plant is taken by the oil industry.

Guyan Machine Shops, Logan, West Virginia, are reported to be inquirying for several pieces of equipment. The company operates a brass foundry.

Connersville Blower Co., Connersville, Ind., operator of a gray iron foundry, has awarded contracts for constructing addition to machine shops.

The Walker Mfg. Co., Racine, Wis., manufacturer of automobile accessories and operator of a malleable foundry, is reported as contemplating purchase of additional equipment.

L. Schiavone & Co., Inc., 54 Broome street, Jersey City, N. J., has been incorporated for $40,000 to manufacture and deal in scrap metals, machine shop and foundry supplies.

Dayton Malleable Iron Co., 1307 West Third street, Dayton, O., has awarded construction contracts to Frank Hillsmith, Inc., for erecting a powdered coal building.

Detroit Gray Iron Foundry Co., 6403 Wight street, Detroit, operator of a gray iron foundry, has retained Mildrier & Eisen, 924 Hammond building, as architects for constructing 1-story, 50x80-foot brick reinforced concrete and steel foundry addition. Harry H. Wyatt, is secretary of the Detroit company.

Carbon Steel Casting Co., Lancaster, Pa., operator of malleable and brass foundries has retained Frank D. Chase, Inc., Chicago, as engineer for a foundry addition.

The Worthington Pump & Machinery Corp., 115 Broadway, New York, has awarded the Austin Co., Cleveland, engineer and architect, contract for constructing 2-story, 80x200-foot, steel constructed pattern storage building.

Receivers have been appointed for the Hamilton Machine Tool Co., Hamilton, O., operator of a gray iron foundry and machine tool builder. Charles I. Anderson and R. S. Radcliffe were named receivers by Judge Walter S. Harlan.

The Richmond Radiator Co., 1480 Broadway, New York, operator of machine shops, foundries, and manufacturer of radiators and radiator parts, has opened an office in Cleveland, in charge of J. H. Bacon, B. F. Keith building.

Troy Foundry Co., Colonie, N. Y., has been formed with 7000 shares $50 par value preferred stock, 70,000 shares $10 par value common stock, with $42,000 actve capital. C. Littlefield,

J. D. Colladay, and J. C. Devroom, are incorporators and J. J. Hegt, 126 Liberty street, New York, is attorney.

The Anchor Brass Works, 145 Stewart street, San Francisco, has been incorporated by George W. Mitchell and A. J. Lindersmth, formerly with W. T. Barratt & Co., to operate brass foundry and machine shops, etc.

The Springfield Pattern Works, Inc., Springfield, Mass., has been formed with $5000 capital, to operate patternmaking and machine shop business, etc., with Arthur E. Wyman, Donald C. Carey and Irving R. Shaw.

Hale Fire Pump Co., Spring Mill, Pa., is constructing an addition to its plant, the added foundry space to be used for casting aluminum and bronze parts used in the manufacture of pumps and fire engnes built by the company.

Flint Malleable Castings Co., 318 Dayton building, Flint, Mich., has taken bids on constructing a 1-story, 36x44-foot foundry of brick. Wright & Nice, Kearsley and Smith streets, are architects.

Charles Mundt & Son, Jersey City, N. J., has retained C. H. Ziegler, 75 Montgomery street, as architect for a 1-story, 50x100-foot brick and steel constructed foundry at 53 Fairmount avenue, that city.

Burton Bronze Co., Grand Rapids, Mich., has been formed with $25,000 capital, to manufacture nonferrous metals and castings, by B. T. Moore, room 514, 110 South Dearborn street, Chicago; W. H. Lindae, and George Peters.

Buckeye Steel Castings Co., Columbus, O., has awarded contracts to the Mt. Vernon Bridge Co., for constructing an addition to its plant. The Buckeye company operates a steel foundry on South Parsons avenue, Columbus.

Louisville & Nashville railway, South Louisville, Ky., has awarded contracts to W. H. Courtney, Tenth street and Broadway, Louisville, for 1-story machine and forge shops at Corbin, Ky.

American Stove Co., St. Louis, operator of foundries in various part of the country, has awarded the White Construction Co., Inc., a contract for erecting a concrete plant at 3012 Skillman place, Long Island City, New York.

Wisconsin Pump & Mfg. Co., Madison, Wis., plans constructing plant for the manufacture of gasoline pumps. W. M. Harks, 445 West Gilman street, Madison, is president of the company.

Contracts have been awarded by Claude E. Sweezy, warden of the state penitentiary, Baltimore, for constructing a foundry, power house, pipe tunnels, etc., to Pamfillis Construction Co., 307 North Gay street, Baltmore. Noted Aug. 1.

Jewell Steel & Malleable Co. of California, Potero avenue and Twenty-fifth street, San Francisco, operator of malleable and steel foundries, has awarded contracts for constructing a 1-story plant addtion.

Kenneth Anderson Co., 133 Atwater street east, Detroit, has been incorporated for $100,000 to manufacture and deal in iron pipe, fittings and steam supplies, etc., by Kenneth Anderson, Nellie I. McVittie, and Norman D. Anderson, of Pontiac.

Southern Wheel Co., Savannah, Ga.; subsidiary company of the American, Brake, Shoe & Foundry Co., Pittsburgh, will enlarge the capacity of its plant to 315 car wheels a day. A larger foundry will be constructed giving the plant a daily melting capacity of 125 tons of iron.

The National Mfg. Co., Ltd., Brockville, Ont., has been formed to consolidate a number of old established Canadian manufacturing companies. It includes the Cossitt Co., Brockville; Canada Stove Co., Ottawa, Ont.; National Mfg. Co., etc.

Marion tScam Shovel Co., Marion, O., operator of gray iron and steel foundries, and builder of excavating equipment, has opened an office in London, in charge of Thurston W. Fairhurst, 16 Abbey house, Victoria street, Westminster, S. W. 1, London.

Independent Foundry Supply Co., St. Louis, has been chartered with $10,000 capital, to manufacture foundry, platers, and polishers supplies. E. J. AuBuchon, Claiborne place; M. A. Bell, 4746 Green street, and T. J. Bell, are incorporators.

Crane Co., 836 South Michigan avenue, Chicago, manufacturer of valves, etc., and operator of gray iron, malleable, steel and brass foundries, has retained Raymond Hood, 18 East Forty-first street, New York, as architect for 1-story, 80x272-foot building of brick and concrete construction at Irving avenue, Ridgewood, New York.

Hanna Engineering Works, 1765 Elston avenue, Chicago, manufacturer of riveting machines, molding machines, foundry equipment, etc., now is represented in Maine, New Hampshire, Vermont, Massachusetts and Rhode Island, by Eggleston Supply Co., 259 Franklin street, Boston.

Geneva Metal Wheel Co., Geneva, O., operator of gray iron foundry and manufacturer of steel automotive wheels, has awarded general contracts to J. H. O'Grody, 2954 Kensington road, Cleveland Heghts, O., for a 2-story, 30x62-foot cupola house. The general contractor is taking bids on subsidiary contracts and materials.

Foundation Co., 120 Liberty street, New York, recently was awarded the contract for constructing locomotive repair shops at Atlanta, Ga., for the Southern railway. The main building will be a double transverse erecting and machine shop for locomotives, 300x325 feet, of steel construction. It will have two 200-ton electric traveling cranes and several smaller cranes.

Ross-Meehan Foundries, Chattanooga, Tenn., manufacturer of steel castings, malleable iron, gray iron and acid resisting castings, heaters, sand dryers, etc., is equipping its new steel foundry with a 3-ton furnace, a 5-ton and a 3-ton electric traveling crane. An annealing oven with core ovens and mold baking ovens, to be electrically heated, also will be installed. The Ross-Meehan company expects the new plant to be in operation some time in December. G. F. Meehan is general manager. Noted Aug. 15.

The Emerson Brantingham Co., Rockford, Ill., recently re-opened its large No. 4 gray iron foundry for custom work. For three years the company has been making malleable castings and now has started production of gray iron in any weight up to 10,000 pounds. The No. 4 foundry was refitted for this work having a daily capacity of 50 tons. For its own implement work a separate gray iron foundry is maintained.

Practically no new equipment will be purchased by the Rhode Island Malleable Iron Works, Hill's Grove, R. I., for the foundry now under construction. Frank D. Chase, Inc., Chicago, is designing the building which will be 104x120 feet, of concrete and steel construction. The equipment from the old plant, on the site of which the new foundry is being constructed, will be utilized for the building being erected. Charles Brown is president and general manager of the Rhode Island company; H. L. Steeves, first vice president; M. M. Marcus, second vice president; J. H. Dickinson, treasurer and E. E. Grinnell, secretary.

New Trade Publications

GEARS—Double helical gear units manufactured by the Lewis Foundry & Machine Co., Farmers Bank building, Pttsburgh, are described by that company in a 16-page bulletin just distributed. Several photographs are shown covering gear units of various horsepowers and for double duo-mills in addition to lubricating systems and flywheels which are tested and finished for both static and dynamic balance. Several types of cut herringbone gears and pinions also are illustrated.

MANGANESE STEEL CASTINGS—A loose-leaf catlog containing information of interest to industrial plants of many kinds, steel mills, blast furnaces, cement plants and foundries, has been issued by the American Manganese Steel Co., Chicago Heights, Ill. A description of manganese steel and its method of manufacture is followed by pages replete with halftone illustration of apparatus made of manganese steel, descriptions of its use and engineering information to aid in ordering.

HANDLING EQUIPMENT—Savings possible through adoption of trucks and lifting devices are shown by pictures, with a minimum of test in a booklet by the Lakewood Engineering Co., Cleveland. Lessened number of men and decreased time necessary for various work constitute a large saving in the average plant.

REFRACTORY LINING—A catalog of 20 pages by the Quigley Furnace Specialties Co., New York, describes a material for bonding and patching brick construction exposed to high temperatures. Proper method of use to obtain best results are described and illustrations are used freely.

STORAGE TANKS—A booklet by the Conveyors Corp. of America, Chicago, describes cast iron storage tanks for the reception of dry, loose, bulky material, such as ashes, coal, sand and gravel. Diagrams of the tanks and halftones of installations illustrate the pages and a table of weights, dimensions and capacities is given.

BEARING METAL—In 96 pages, pocket size, the Magnolia Metal Co., New York describes its bearing metal and gives simple instruction for taking and operating lined bearings. Comparative tests of the metal with others are given with halftones of the result of various pressures for varying periods.

PLANT CONSTRUCTION—The Watson Co., architects and engineers, Cleveland, has issued a booklet showing various office and manufacturing structures planned and erected for a number of clients and uses.

ELECTRICAL SUPPLIES—The General Electric Co., Schenectady, N. Y. has published an exceptionally interesting booklet showing views of the various plants of the company which are scattered throughout the country. Views of the plant interiors also are shown illustrating some of the processes connected with the manufacture of electrical machinery.

HANDLING EQUIPMENT—In a general catalog, the Webster Mfg. Co., Chicago, lists a wide variety of equipment for the mechanical handling of materials, from simple link chains to coal tipples, with all necessary information for choosing and ordering. Illustrations include halftones of equipment and installations and drawings of many devices with dimensions and angles.

TOOL STEEL—A treatise on the use and handling of tool steel together with considerable data is issued in pocket size by the Columbia Tool Steel Co., Chicago Heights, Ill. The aim of the booklet is to give users of tool steel such information as will produce the best results. Special attention is paid to the causes of tool hardening, failures and indications by which they can be recognized.

REFRACTORIES—Higher temperatures demanded in modern metallurgical operations require higher duty refractories. The Norton Co., Worcester, Mass., has issued a catalog of its products for refractory purposes. An interesting feature of the publication is a chapter devoted to the standard shapes of refractory bricks as adopted by the Refractories Manufacturers association.